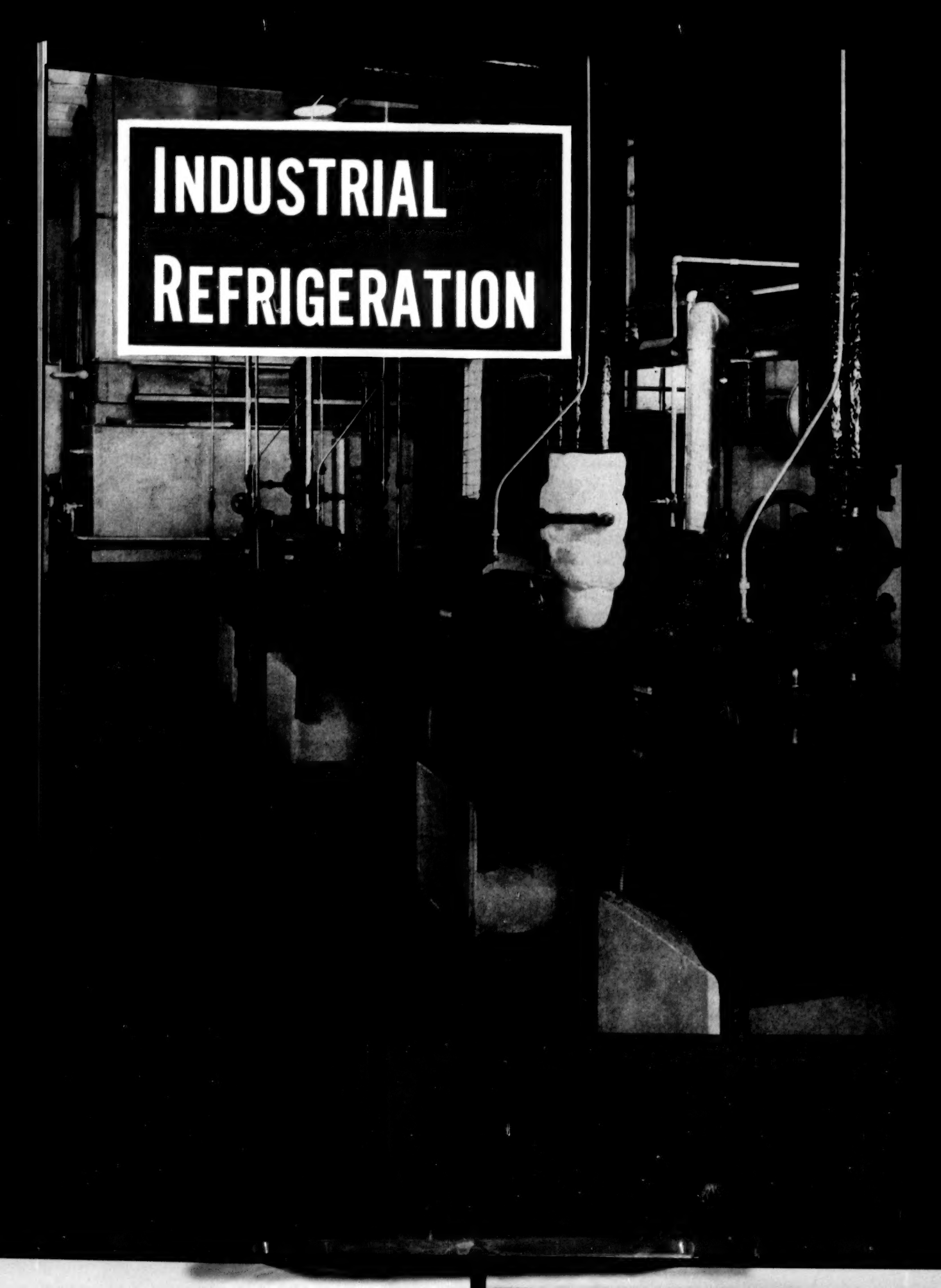

INDUSTRIAL
REFRIGERATION

26,000
H.P.H.*

*
Highballs per Hour: Using one cube per glass, it would take 73 bartenders—working full time at ten seconds per drink—to keep up with the output of this G-W super-cuber.

Completely automatic, this Gifford-Wood Type A Cuber shoots out perfect ice cubes at the rate of 26,000 per hour and minimizes ice waste. It accommodates a 300- to 400-pound cake which is held firm on the loading plate, aligned with the precision cutting saws. And, as soon as this first cake is ¾ cut, a second cake slides easily into place pushing the remaining quarter into the saws. This means no waste—every piece of ice is saleable. There's a further benefit, too—all parts coming in contact with the ice are not only sturdy, but completely corrosion-proof—your guarantee of minimum maintenance cost. For full information, write for Bulletin 488.

GIFFORD-WOOD CO.

Since 1814

HUDSON, N. Y.

New York 17	St. Louis 1	Chicago 6
420 Lexington Avenue	Railway Exchange Bldg.	565 W. Washington St.

Pacific Coast Representative:
Western Ice Equipment Company, 420 Market St., San Francisco 11

Screw Bucket-Elevator Conveyor Breaker

8499

VESTIBULE TYPE TRACK DOOR

YEARS OF SATISFACTION

"Butcher Boy"

Quality Since 1885

WHY "BUTCHER BOY" DOORS ARE THE FINEST REFRIGERATOR DOORS BUILT!

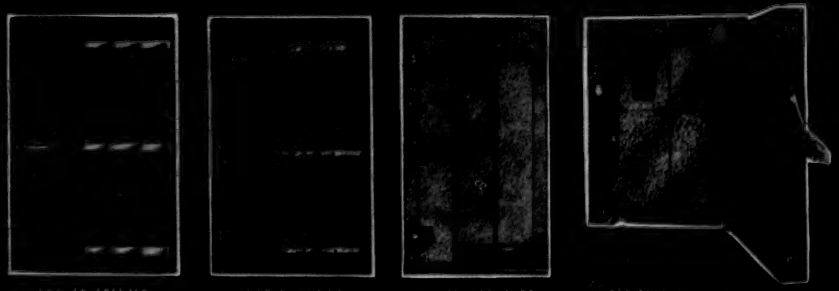
These Exclusive Features Furnished At No Extra Cost

DOOR STRUCTURE

HARDWARE

APPEARANCE

When a Man Thinks Twice ...He Makes Comparisons



COOLERATOR FREEZER

EXTRA PLYWOOD

LOW TEMPERATURE

SUPER FREEZER OVERLAP

BUTCHER BOY REFRIGERATOR DOOR CO. HARVARD, ILLINOIS

"Aisle-matched" to reduce idle space

THE ARTIST'S DRAWING above shows that *whatever the width of your warehouse aisles there's a Lewis-Shepard Master Truck to match.* Shown are four L-S Master Trucks right-angle stacking the same 2000 lb., 40" long load in various size aisles. *You* decide the most practical aisle width . . . then select the Master Truck that matches *your* requirements.

Remember, Lewis-Shepard offers you *every type of truck made* — from lightweight two-wheelers to huge fork lifts . . . the *only* complete line of materials handling trucks on the market. And, because your local L-S Representative has this *complete* line, he's in a better position to advise you . . . he's not biased in favor of one type truck or design.

Dependable L-S Master Trucks are ordered and reordered by "blue-chip" companies. Recent reorders include:

Electrical Goods Mfr.	105 L-S in use — reordered 7
Rubber Mfr.	13 L-S in use — reordered 2
Spark Plug Mfr.	20 L-S in use — reordered 1
Aluminum Mfr.	14 L-S in use — reordered 4

Illustrated are: (A) JackStacker, 4000 lb. cap. electric "walkie"; (B) Model "J", 2000 lb. cap. riding type at ½ the usual cost; (C) Model "M", 3000 lb. cap., most compact of all riding types; (D) Model "E", 2000 lb. cap., fastest of all electrics.

Write for an L-S "Space Wheel" . . .
tells you aisles required for L-S Trucks and probable savings. Use the coupon.

LEWIS-SHEPARD

266 Walnut St., Watertown 72, Mass.

"The Master" Line

Please send
- ☐ L-S Space Wheel
- ☐ (A) L-S Master JackStacker Catalog #34
- ☐ (B) L-S SpaceMaster Model "J" Catalog #33
- ☐ (C) L-S SpaceMaster Model "M" Catalog #35
- ☐ (D) L-S SpaceMaster Model "E" Catalog #32

Name .....

Company .....

Address .....

STAND-OUT

Research

A COMPREHENSIVE picture of research that is opening the frontiers for refrigeration and refrigerated storage is provided in the list of 125 projects that the Cold Storage Research Advisory Committee of The Refrigeration Research Foundation reviews each year.

To give TRRF members a comprehensive view of scope, The TRRF Information Bulletin lists a portion of these projects. The list, and the work of the committee, is very closely related to the activities of TRRF, because TRRF is doing everything possible to promote some of these, as well as other projects, that are foremost in importance to the welfare of the refrigerated warehousing industry. A partial list of projects, representative of the total, follows:

Use of antibiotics for control of decay in storage.

Values of irradiation in the storage of foods.

Value of ultrasonic energy in the preservation of foods.

Pasteurized juices — factors affecting their shelf life.

Storage of evaporated milk.

Development of a satisfactory frozen milk concentrate.

Condensation of moisture in truck bodies.

Leakage and purification of air in storage rooms.

Education in proper refrigeration for maintenance of food quality.

Effect of fluctuating temperatures on various frozen foods.

Basic factors involved in precooked frozen foods.

Suitability of new fruits and vegetables for processing.

Frozen bakery products.

Superconcentrates of fruit juices — their feasibility.

Comprehensive study of enzyme action in frozen foods.

Improvement in quality of frozen blackeyed peas.

Preparation of pulp-fortified pink grapefruit concentrate.

Prepackaging of cold-sensitive fruits.

Constituents of fruits and vegetables that affect processing quality.

Off-flavors of fresh and processed fruits due to foliage sprays.

Statistical and management studies of locker plants.

Shrinkage of meats during freezing and storage.

Bacteriology of frozen meats.

Problems of refrigeration in transportation.

Cold storage of seeds.

Cold storage of floricultural products (bulbs, corms, etc.).

Packaging of frozen foods — export packaging, etc.

Effects of relative humidity and air velocity on refrigerated commodities, and during freezing.

Post-harvest physiology of fruits and vegetables.

Industrial Refrigeration

formerly ICE AND REFRIGERATION

Now in its 64th Year of Publication

J. F. NICKERSON, FOUNDER

Vol. 128 **June, 1955** **Number 6**

Contents

Los Angeles Grocer Chain Builds Own Frozen Food Storage Plant 15
Continuous Plate Feed Freezer Speeds Up Processing Of Frozen Foods 18
Dry Ice and Brine Refrigerants Used For Low Temperature Carilloy Tests 21
College Ice Skating Rink Provides Floor For Sports 22
Modernizing The Older Multi-Story Warehouse 23
Air Conditioning Improves Temperatures For Metal Parts Plant 25
Meat Packer Reports — Says Mechanically Refrigerated Freight Cars Offer Answer to Shipping Meats 26
ASRE Semi Annual Meet at Milwaukee 52
Innovations in Apple Handling Methods and Equipment 54
National Association Practical Refrigeration Engineers 34
Vapor Barrier Requirements for Cold Storage Structures 34
From the President's Desk 39
NAPRE Chapters Revive Educational Conference 40
News Notes and Chapter Activities 43
NAPRE Question Box 47

Departments

What's New in Equipment ... 4
Press Briefs 10
The Spotlight 13
Deaths 58
Manufacturers News 59
Catalogs and Bulletins 60
Coming Conventions 57

The Cover:

Compressor room in Ralphs Frozen Foods storage plant, Los Angeles, California, showing evaporative condensers, two six-cylinder second stage compressors, two six-cylinder booster ammonia compressors, suction trap, intercooler and associated piping. See story on page 15.

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What's New

MACHINERY
APPLIANCES • PROCESSES

Spray Chiller Delivers High Heat Transfer Rate

AN improved type of liquid chiller is announced by the J. E. Watkins Company of Maywood, Ill. It is said to deliver a heat transfer rate as much as double the rate obtained by immersion or dry expansion type chillers.

The upper horizontal drum contains a conventional bank of tubes through which flows the material to be cooled. Liquid refrigerant is sprayed over the tube bank and absorbs its heat of evaporation from the tubes. Refrigerant vapor is drawn out of the top of the upper drum.

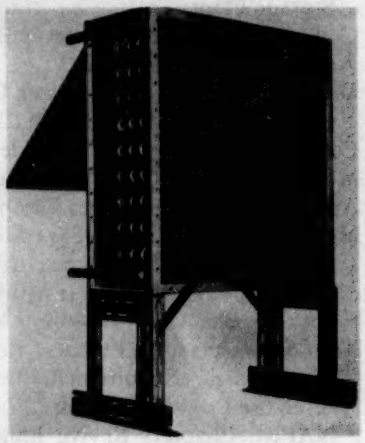
Excess liquid is drained from the upper horizontal drum to a lower drum. When the liquid rises in the lower drum to its upper control level, the drum automatically switches from the draining cycle to the pumping or return cycle. By means of high pressure gas from the receiver (or from the condenser), the excess liquid is "pumped" back to the chiller sprays. When the liquid falls to the lower control level, the drum automatically switches from the pumping cycle back to the draining cycle.

For "Freon" systems, the operation is essentially the same except that a special type of oil separator is included which returns the separated oil to the crankcase of the compressor.

The Spray Chiller is an adaptation of the Watkins Recirculator (Patented). It is designed to use any refrigerant, current applications using ammonia and the Freons. Any fluid material may be chilled; current applications include the chilling of brine for skating rink freezing, water for air conditioning systems, and "Aerosol" liquids. Other advantages claimed for the design include: low refrigerant charge, much reduced cooling surface, guarantee against slugs to the compressor.

"No Water" Condenser

NEW air cooled condenser units are now in production by Peerless of America according to company executives. Known as the Hi-F "NW" series, these air cooled, "no water" condensers are available for indoor or outdoor installation in unit sizes to 10 tons and stands to accommodate multiple units to 40 tons.



New Air Cooled Condenser introduced by Peerless of America

By their elimination of water in refrigerant condensing, the air-cooled "NW" units provide important advantages. Because of their simplicity and economy, they are the practical answer to remote condenser problems. The maintenance problems characteristic of wet systems, such as water hardness, deterioration of constantly wet surfaces, winter conditions, and difficulties with floats and valves are eliminated. Also eliminated are the problems arising during water-shortage seasons from local ordinances restricting use of water.

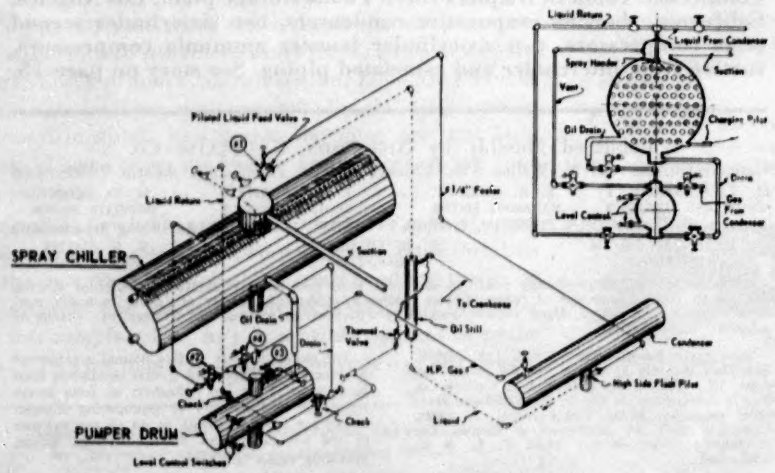
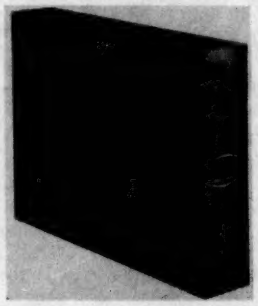


Diagram of Watkins Spray Chiller — Recirculator For Any System.

Automatic Defrost Device

THE HEAT-CEL by Dole Refrigerating Co., is a holdover plate which stores heat for defrosting low temperature evaporators. It may be used on new or existing installations. Advantages claimed are: the convenient plate design allows for easy mounting and an independent source of heat for the plate solution gives consistent defrosting performance regardless of varying ambients. A low wattage heater controlled by a thermostat temperature of the solution in the Heat-Cel at a point for maximum defrosting efficiency.



Each Heat-Cel includes a kit consisting of a timer, solenoid valve and a shut-off valve. At the present time three standard sizes are available, known as the HC1E, HC2E, and HC3E, for use with a 1, 2 and 3 hp condensing units either air or water cooled.

The timer is adjustable to give defrost periods ranging from one hour to twenty-four hours depending upon the severity of service. A fan delay is also incorporated to prevent the fan from operating when the coil is above freezing. The use of the electric heater element in the Heat-Cel gives positive results so that the amount of heat available does not depend on such hard to control factors as surrounding ambient temperatures, compressor head or operating time.

Fire Extinguisher For Low Temperatures

A FIRE extinguisher that functions at temperatures of 65 degrees below zero Fahrenheit, has been developed by Ansul Chemical Company, of Marinette, Wis., pioneer producer of dry chemical fire equipment.

Originally designed to meet U. S. Air Force specifications for the Arctic and other cold weather areas, the extinguishers have a special rubber hose that is able to withstand the extreme cold without stiffening or cracking. Also, nitrogen, rather than carbon dioxide, is used to expel the extinguishing agent, which is a dry chemical.

Carbon dioxide is used to expel the chemical in Ansul's regular portable units, but because it freezes in the extreme cold, it was deemed inadequate for the cold weather extinguisher.

The new units are available in 4-pound and 20-pound capacity hand portable units and 150-pound and 350-pound wheeled units. They are equipped with special nozzle and puncture pin seals to insure proper operation in extreme cold.

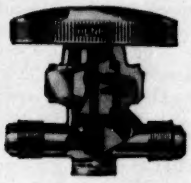
HENRY LINE VALVES really give you something extra

They give more dependable service because of advanced field-proven design and construction as well as patented features.

PACKLESS VALVES
FOR FREON
with Exclusive Balanced-Action

STANDARD TYPE

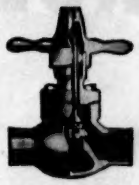
Ball check in balancing channel permits diaphragm inspection and replacement with valves under line pressure. Sizes ¼" thru ⅝" flare; ¼" thru 1⅝" O.D. Solder, ¼" thru ½" F.P.T.



BLUE BANTAM TYPE

Same as standard Balanced-Action valve except that diaphragms cannot be inspected or replaced under line pressure. Size ¼" thru ⅝" flare and O.D. Solder.

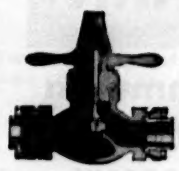
PACKED VALVES
FOR FREON
Bronze-Wing Cap Type



Globe and angle types with solder connections, bolted bonnets, sizes ⅞" thru 4⅛" O.D.

SEMI-STEEL WING CAP TYPE

With bolted bonnets, complete with companion flanges. Available in globe and angle types in sizes 1¼" thru 6". Can be furnished with separate forged brass O.D.S. adapters, or separate steel butt weld adapters. Valves are also supplied with one piece forged steel flanges with F.P.T. connections or slip-on welding connections. Also Globe and angle types with F.P.T. connections, sizes ½" thru 2½".



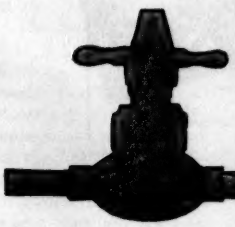
PACKED VALVES
FOR AMMONIA
Permanent-Mold Iron and Semi-Steel

Compact and strong with self-aligning stem disc. Sizes (F.P.T.), screw bonnet: ¼" thru 1", bolted bonnet 1¼" thru 2½"—with flange connections 1¼" thru 6"—both flange and angle types.

HENRY—Standard equipment by leading Manufacturers, Army, Navy, Coast Guard and Maritime Commission • Stocked by Leading Jobbers

WRITE FOR CATALOGS

HENRY VALVE CO.



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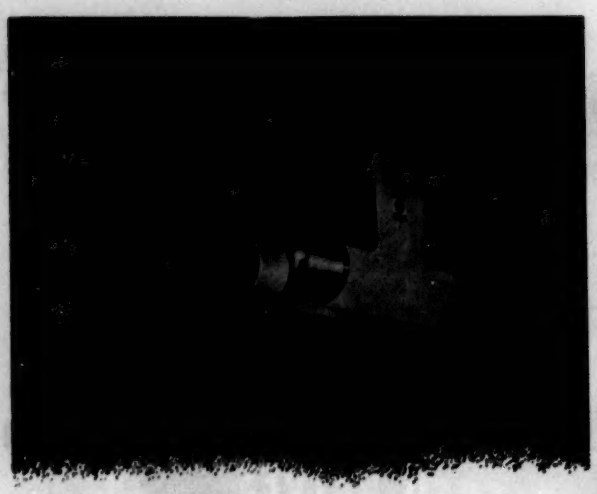
CONTROLLING FLOW

Valves—Driers—Strainers—Control Devices and Accessories for Refrigeration, Air Conditioning and Industrial Applications

MELROSE PARK, ILL. (CHICAGO SUBURB)
CABLE: HEVALCO, MELROSE PARK, ILLINOIS

®



Announcing

EXTRA LARGE

Capacity...

THERMOBANK

for Freon and Ammonia

NOW...no job is too large for the KRAMER THERMOBANK

The only completely automatic system for freezing temperatures offering these extra large capacities. THERMOBANK requires no manual attention whatsoever.

Ceiling mounted, THERMOBANK takes no precious floor space. You can store products directly under the unit.

Can be used as an independent system or with an existing large system without affecting the operation of other evaporators.

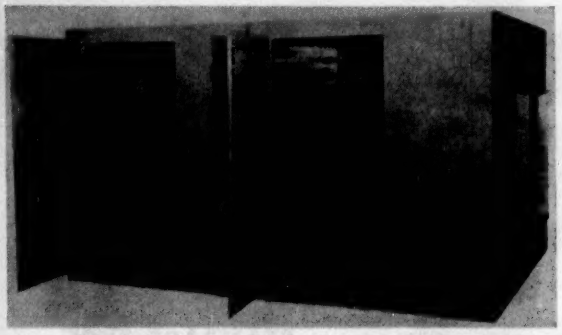
WRITE FOR BULLETIN TA249-F

KRAMER TRENTON CO.
Trenton 5, N.J.

New Heating-Ventilating-Cooling Unit

A NEW combination heating-ventilating-cooling unit designed with the problems of dairy and food processing plants in mind has been introduced by the King Company of Owatonna, Minn. manufacturers of air movement systems.

Housed in an insulated galvanized steel casing, the Klimatic King is designed to handle large volumes of air, especially the humid air so prevalent in dairy and food processing plants. Essentially a central forced air system, the Klimatic King is prefabricated in two sections for easier handling and installation, a blower section, and heating coil, bypass damper and filter section. A cooling section designed for Freon or chilled water refrigerants may be added at time of initial installation or later if desired.



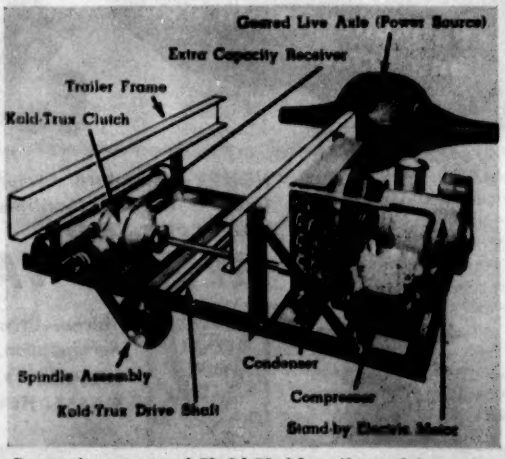
New Heating-Ventilating-Cooling Unit designed for dairy and food processing plants.

Desired room conditions, heating, ventilating and cooling are automatically controlled by fresh and recirculated air dampers as well as face bypass coil dampers to control the quantity of air passing around the heating coil. Both fresh and recirculated air is filtered through permanent, washable type filters to keep food products, free from contamination. A two-speed blower motor permits operation of the system at high speed during processing periods and at lower speed during "off periods" and in cooler weather for greater power economy.

The new unit is available in several sizes from 3,500 cfm to 20,000 cfm and may be supplied for use outside on roof areas without special weatherproofing.

Live Axle Used as Power Source For Trailer Refrigeration Unit

A COMPLETELY automatic and thermostatically controlled trailer refrigeration system operated off a live trailer axle has been introduced by the Kold-Hold Division of Tranter Manufacturing, Inc., Lansing, Mich. An addition to the Kold-Trux line of "Mobilmatic" truck and trailer refrigeration units, the



Operating parts of Kold-Hold trailer refrigeration system

system is not connected in any way to the engine of the tractor. Thus, it leaves the engine and operating mechanism of the trailer free for normal maintenance and it puts no load on the trailer's electrical system.

A geared axle (the same type of axle used for driving a 4-wheel truck) is substituted for a standard axle on the trailer. As the trailer is pulled by the tractor, the rotation of the wheels rotates the live axle. This motion of the axle is transmitted to the condensing unit through a patented Kold-Trux clutch which eliminates all shock to the engine, transmission or compressor.

The Kold-Trux trailer unit has ample capacity for developing desired refrigeration under maximum operating conditions and temperatures. It will maintain any specified temperature from minus 20 to 50 F throughout the entire trip regardless of its length. It can produce different temperatures in each compartment of a dual compartment body and different temperatures on different trips. For example, low temperature products can be refrigerated at below zero temperatures on one trip. Then, on the return trip, high temperature perishables can be refrigerated at the temperature best suited to their protection anywheres from 33 to 50 F.

Kold-Trux trailer units are available in 2 and 3 hp models with single and twin condenser units. They are equipped with either a 2 or 3 hp electric motor for stand-by operation.

Vestibule Checks Freezing At Refrigerated Entrance

A NEW vestibule design which overcomes all shortcomings of previous designs has been introduced by The King Company of Owatonna, Minnesota. The vestibule is intended for use at the location of walk-in or loading doors at entrances in refrigerated rooms. Robert K. Rowley, chief engineer, has included in the design features that entirely eliminate the problem of moisture condensing on walls and cold room door only to freeze on the floor and around the doors, creating no end of trouble.

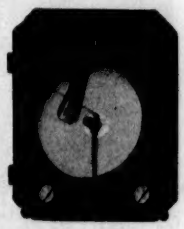
King vestibule at entrance to refrigeration room

When warm, moist air enters the King Kold Wall Vestibule, it collects on the walls and ceiling of the structure. Because the King Kold Wall Vestibule is made of non-insulated metal, the wall and ceiling temperature is the same as the cold room temperature. On contact with the vestibule panels, the entering moisture immediately condenses and freezes on the panels, instead of running down onto the floors to freeze to cause door sticking.

The King Kold Wall Vestibule is prefabricated approximately 5 ft. 6 inches wide and will be produced in two models for 3 ft. 6 inch and 4 ft. 6 inch doors. The air lock is fabricated of heavy angle iron framework and a set of double-swinging self-closing doors are installed four inches inside the cold room wall. Vestibule walls and ceiling are demountable light metal panels. Because of the low temperature on these panels, the moisture turns to a snowy frost which may be easily brushed off. After extended operation the panels may be easily removed to a warm room where they are defrosted and then reinstalled.

Taylor specializes in taking TEMPERATURES

WHETHER you want to control and record them, simply record them, or just have a clear, accurate indication of what they are, there's a Taylor instrument that will do the job superlatively well. Help you cut costs; give you new efficiency. Here are just a few of the wide selection. A postcard will bring you *Catalog 300*, with detailed information, or call your Taylor Field Engineer. Taylor Instrument Companies, Rochester, N. Y., and Toronto, Canada. *Instruments for indicating, recording and controlling temperature, pressure, flow, liquid level, speed, density, load and humidity.*



TAYLOR FULSCOPE* CONTROLLER

For *tanks, brine lines, compressors*, etc. Probably the most versatile instrument made for temperature, pressure, flow and liquid level control. Easily adaptable to any operating conditions.

TAYLOR RECORDING THERMOMETER

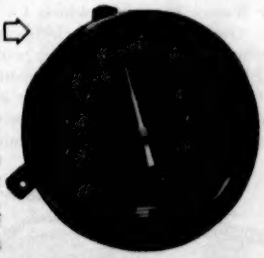
For *brine tanks, brine and ammonia lines, bunker rooms*, or any process in refrigeration where temperature record is required. Available to record in one, two or three different temperatures.

TAYLOR INDUSTRIAL THERMOMETER

For installation in insulated lines. Sturdy, one-piece, shallow case for wide angle of vision. Triple lens BINOC* tubing and bold, contrasting scale make this the easiest to read of all industrial thermometers. Straight or 90 angle stems. Many other types, ranges and angles.

NEW 6" DIAL INDICATOR

For temperature or pressure applications, where periodic reference only is required. Mercury, gas, organic liquid or vapor actuation, as desired. Variety of ranges. All new movement minimizes linkage error—gives greater accuracy throughout span. Fume and moisture proof case can be face or flush mounted.



*Reg. U. S. Pat. Off.

Taylor Instruments
MEAN ACCURACY FIRST

Steel Containers for Small Packages in Storage

GALVANIZED steel wire mesh containers known as "Cargotainers" are manufactured by the Pittsburgh Steel Products Company, Pittsburgh, Pa. for handling meats or other products in small packages. The capacity is 2,000 pounds and size 40 x 48 x 24 inches. These containers are adaptable for fork lift trucks and can be stacked three high. Each unit weighs 175 pounds.

Cargotainer with 1200 pounds of hams being moved into storage.

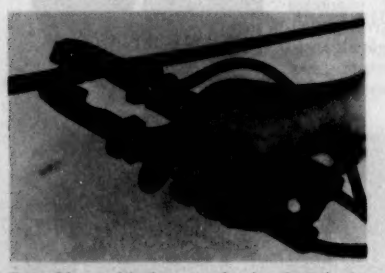
It is claimed that they accomplish substantial savings in handling and storing small packages. Reinforcing around the perimeter of the base is provided by a rectangular bar. When not in use they can be collapsed so that four of them occupy approximately the space of one. To keep loaded containers above the floor level in storage areas, a wooden platform base is available.

New Pliers Tool For Soldering Copper Tubing

A NEW tool for soldering copper tubing is the Portable Soldering Set developed by Wassco Electric Products Corp., Joliet, Ill. Consisting of an all-electric pliers soldering device in conjunction with a portable power unit, this equipment features safety and ease of use as there is no open flame, burn or fire hazard. It operates from the nearest power outlet, eliminates gas supply problems and is fast to rig and start work, according to the manufacturer.

The unit is used primarily for soldering copper tubing "sweat" fittings up to 1¼ inch size. However, it also works with ease and efficiency on heavy electrical wire and cable, such as in heavy motor manufacture, repair and power line work, and on many other heavy soldering jobs.

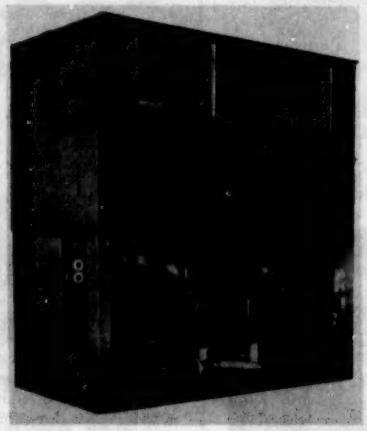
Its advantages include easy portability, including a pocket in the case for pliers and leads, convenient push-button heat control in the pliers handle, and ten-foot leads.



Portable soldering tool developed by Wassco Electric Products Corp.

Typhoon Announces New 30-Ton Packaged Unit

A NEW 30-ton self-contained air conditioning unit, claimed to be the most compact unit of that capacity in the industry, is being manufactured by the Typhoon Air Conditioning Company, Inc. An important feature of the new unit is that



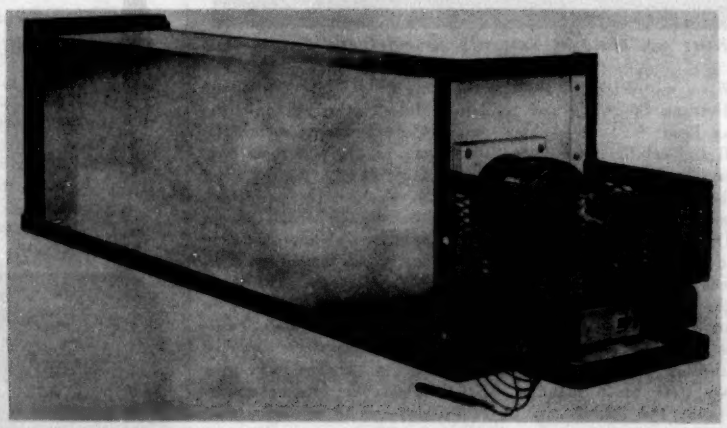
New Packaged Unit for Air Conditioning

it is the only packaged unit of such capacity to have its machinery entirely free-floated on springs and in no way in contact with the cabinet. This construction reduces operating noise level to a minimum, and permits installation of the unit in many places where noise and vibration problems might ordinarily make a 30 ton application inadvisable. It is designed for application as a free-standing air conditioner, or with ductwork as a central system. In free-standing applications, it may be conveniently split for remote installation of the high side, with the cooling section suspended from the ceiling or recessed flush with an interior wall of the building. This feature is especially valuable in commercial establishments such as supermarkets, where working floor space is at a premium. Its dimensions are 92 by 84 by 45 inches. Equipped with an all-copper condenser, two full-width blowers, and an open type compressor, the 30 ton unit may be furnished with capacity control to adjust machine capacity to varying cooling load requirements. This means that, when its full 30 tons of cooling capacity are not needed, the unit will perform at lower capacity, with resultant savings in operating costs.

Truck Refrigeration Unit For Dry Ice

CALLED Frigi-Matic by the manufacturer, Foster-Built Bunkers, Inc., a new dry ice truck refrigeration unit offers thermostatic temperature regulation. The automatically controlled bunker maintains constant temperatures, with a range from zero to 70 F and is claimed by the manufacturer to effect savings in dry ice consumption.

Foster-Built makes a complete line of dry ice bunkers, from the small refrigerette, with 50 pounds dry ice capacity, to the new frigi-matic with 200 pounds dry ice capacity. These bunkers offer low cost refrigeration for all types of perishable loads, both frozen and non-frozen. Easy to install, the bunker is simply constructed: the main body has a two-inch false bottom which acts as a refrigerating air duct, and the dry ice chills the top metal plate of the air duct. A low amperage sirocco-type fan forces the air along the length of the chilled metal plate, effectively lowering the temperature of the air. Chilled air is then circulated through the body of the truck. Some models maintain refrigeration without re-icing for over fifty hours. The automatic temperature control is also being offered.



New Dry Ice Truck Refrigeration Unit Made by Foster Built Bunkers

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FAST FACTS ABOUT genetron Super-Dry Refrigerants

"Genetron" *Super-Dry* Refrigerants are made by General Chemical Division, Allied Chemical & Dye Corporation, one of America's great producers of industrial and scientific chemicals for more than 50 years. Long a leader in fluorine chemistry, General has the mines, resources, reserves, experience and production facilities that make it a reliable source of fluorinated hydrocarbon refrigerants.

Careful control in the manufacture of "Genetron" refrigerants guarantees products of the highest quality, extremely low in moisture and other impurities. "Genetron" Refrigerants are identical and interchangeable in all respects with comparable fluorinated hydrocarbon refrigerants produced by any other manufacturer meeting the same high quality refrigerant standards and specifications. They have been tested exhaustively by major manufacturers and are being used in their air conditioning and refrigeration equipment.

- **Guaranteed: Exceptionally low moisture content**
- **Non-corrosive to standard equipment materials**
- **Non-toxic, non-flammable, stable, safe**
- **Critical and freezing points well outside range of operating uses**
- **Solvent action on oil helps prevent solidification or congealing of lubricant**
- **Miscible with oil; aid in lubrication of equipment**

genetron 11 ORANGE LABEL
Trichloromonofluoromethane

genetron 12 WHITE LABEL
Dichlorodifluoromethane

genetron 141 GREEN LABEL
Monochlorodifluoromethane

Selected Physical Data

	CCl_3F	CCl_2F_2	$CHClF_2$
Chemical Formula			
Molecular Weight	137.4	120.9	86.5
Boiling Pt. (°F) at 1 Atmosphere Pressure	74.7	−21.6	−41.4
Evaporator Pressure at 5°F (p.s.i. absolute)	2.93	26.52	43.02
Condensing Pressure at 86°F (p.s.i. absolute)	18.3	108.0	174.5
Freezing Point (°F) at 1 Atmosphere Pressure	−168.0	−247.0	−256.0
Critical Temperature (°F)	388.4	232.7	204.8
Critical Pressure (p.s.i. absolute)	635	582	716
*Compressor Discharge Temperature (°F)	113	102	131
Compression Ratio (86°F/5°F)	6.24	4.08	4.06
Liquid Viscosity at 5°F (centipoises)	0.650	0.328	0.286
Liquid Viscosity at 86°F (centipoises)	0.405	0.251	0.229
Vapor Viscosity at 1 atm. and 5°F (centipoises)	0.0096	0.0114	0.0114
Vapor Viscosity at 1 atm. and 86°F (centipoises)	0.0111	0.0127	0.0131
Saturated Liquid Density at 5°F (lbs./cu. ft.)	97.88	90.00	83.34
Saturated Liquid Density at 86°F (lbs./cu. ft.)	91.38	80.63	73.36
Saturated Vapor Density at 5°F (lbs./cu. ft.)	0.0815	0.6735	0.8034
Saturated Vapor Density at 86°F (lbs./cu. ft.)	0.4461	2.569	3.213
Specific Volume of Vapor at 5°F (cu. ft./lb.)	12.27	1.485	1.246
Latent Heat of Vaporization at 5°F (B.t.u./lb.)	84.0	69.5	93.5
Net Refrigeration Effect of Liquid 86°F/5°F (B.t.u./lb.)	67.5	51.1	69.3
Specific Heat of Liquid at 86°F (B.t.u./lb. °F)	0.209	0.243	0.335
Specific Heat of Vapor at Constant Pressure of 1 atm. and 86°F (B.t.u./lb. °F)	0.13	0.14	0.15
Specific Heat Ratio at 86°F at 1 atm. (k = Cp/Cv)	1.14	1.14	1.18
*Coefficient of Performance	5.00	4.69	4.65
*Horsepower/Ton Refrigeration	0.943	1.005	1.016
*Refrigerant Circulated/Ton Refrig. (lbs./min.)	2.96	3.91	2.89
*Liquid Circulated/Ton Refrig. (cu.in./min.)	56.0	83.8	68.1
*Compressor Displacement/Ton Refrig. (c.f.m.)	36.3	5.81	3.60
Thermal Conductivity of Liquid at 86°F (B.t.u./hr./sq.ft./°F/ft.)	0.0609	0.0492	0.0595
Thermal Conductivity of Liquid at 32°F (B.t.u./hr./sq.ft./°F/ft.)	0.0680	0.0559	0.0704
Thermal Conductivity of Vapor at 86°F (B.t.u./hr./sq.ft./°F/ft.)	0.0048	0.0056	0.0068
Thermal Conductivity of Vapor at 32°F (B.t.u./hr./sq.ft./°F/ft.)	0.0045	0.0048	0.0060
Toxicity (Underwriters' Laboratories Group No.)	5	6	5A
Flammability & Explosivity	none	none	none
Relative Dielectric Strength of Vapor (compared with Ethyl Chloride as Unity)	3.00	2.40	1.31
Odor	Ethereal	Ethereal	Ethereal
Type of Compressor in Which Usually Used	Rotary & Centrifugal	Reciprocating & Rotary	Reciprocating
Evaporator Temperature Range	30 to 50°F	0 to 50°F	−130°F to 0°F
Solubility of Water in Liquid Refrigerant at 32°F (gm./100 gm. Refrigerant)	0.0036	0.0026	0.060
Solubility of Water in Liquid Refrigerant at 86°F (gm./100 gm. Refrigerant)	0.013	0.012	0.15
Oil Solubility (Miscibility with Lubricating Oils)	yes	yes	yes**

*Based on 5°F Evaporator Temperature and 86°F Condenser Temperature.
**Separates into two phases at lower temperatures.

FREE! VALUABLE NEW FOLDERS! Write today for important new informative folders, "Genetron" Super-Dry Refrigerants for Air Conditioning and "Genetron" Super-Dry Refrigerants for Refrigeration.

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Utah—Salt Lake City—Louis A. Roser Co.
Wisconsin—Milwaukee—Reichel-Korfmann Co.

PRESS BRIEFS

U.S. Cold Storage Elects Officers

AT the annual meeting of stockholders of the United States Cold Storage Corporation held April 26, E. M. Dodds of Kansas City was elected Chairman of the Board and chief executive officer. E. E. Hesse was elected president.

Mr. Dodds is a veteran in the cold storage business and was the first employe of the United States Cold Storage Corporation when it was launched in 1919. Mr. Hesse formerly was executive vice-president. All other officers were re-elected or re-appointed. R. M. Conner, a vice-president of the company, was elected to the Board. The Board, in addition to Dodds, Hesse and Conner, includes E. F. Blettner, Jr., J. R. Dow, P. R. Gates, Grier D. Patterson, L. D. Schreiber and Orville Taylor.

The United States Cold Storage Corporation operates cold storage and merchandise storage warehouses in Chicago, Dallas, Detroit, Fort Worth, Kansas City, Mo., Omaha and Port Lavaca, Texas, and is one of the three largest concerns in that industry.

Southland Offers Scholarship Awards

A SCHOLARSHIP awards program through which $3000 in college grants will be offered annually to children of employees of Southland Corp., Dallas, Texas, has been announced by Joe C. Thompson, president. Beginning this year, three $1000 awards will be made available annually, one in each of the firm's three divisions — Southland Ice Co., Seven-Eleven Food Stores and Oak Farms Dairies.

The Dallas firm employs 65 Houston residents in the operation of two of its divisions, Seven Eleven Stores and Oak Farm Dairies, in the Houston area. Each grant will be awarded over a four-year period in annual installments of $250, to be used at any college or university of the winner's choice. The corporation employs some 1200 people in Texas.

New Frozen Foods Plant

CONTI Products, Inc., new frozen foods company, has opened a plant in Reynoldsburg, near Columbus, Ohio, for production of frozen foods. Products are Italian ravioli, Italian polpetta (meat dish), Hungarian barley, and Hungarian cabbage rolls. These products will require only reheating before serving, being completely cooked. They will be packaged in an aluminum casserole-like container, and each package will be sufficient for four servings. Franco Conti, 4040 E. Broad street, Columbus, is principal owner and operator of the new firm.

Foremost Dairies Report

FOREMOST Dairies Inc., carned 27 cents a share in the first quarter, Grover D. Turnbow, president, told the annual meeting. This represents a gain of 27.7 percent over the like 1954 period by Foremost and the several other dairy companies it has since acquired. Paul E. Reinhold, chairman, predicted the company will earn about $1.50 a share this year if profits continue at the rate established in March. He said March is usually the average month for the dairy industry.

ALLIED CHEMICAL & DYE CORPORATION
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Basic Chemicals for American Industry

Frozen Poultry Research

REPORTS this year from meetings of the National Turkey Federation, Institute of American Poultry Industries (Fact Finding Conference), and Pacific Dairy and Poultry Association have revealed that some investigation is in order on the question of toughness. That is, an opportunity to make further improvement appears to lie in that direction.

At the Western Utilization Research Branch of USDA in Albany, Cal., the Poultry Products Section has already conducted preliminary tests (following reports from the earlier meetings) and these have shown that some aging along the route, before freezing or after thawing, is effective in tenderizing frozen turkeys and chickens. More elaborate study will be undertaken to learn the influence of conditions before slaughter, during processing and holding, etc., so that practical recommendations can be made.

Both the Institute of American Poultry Industries and TRRF have been consulted in this matter and both organizations are very much interested and willing to cooperate in ways that will facilitate the studies.—TRRF Bulletin.

Research Committee Meets with Manufacturers

MEMBERS of the National Association's Research and Marketing Committee and engineers of some of the country's leading Ice crusher and cuber manufacturers sat down together recently in St. Louis, for a talk about their mutual interests and problems.

The conference was the first of a series of meetings with manufacturers of equipment sponsored by and participated in by the Association. The purpose of the session was to discuss the changes which have taken place in the manufacturing, processing, handling and selling of prepared ice with a view to bringing about changes in equipment which will be of benefit to all concerned.

The main topics considered were crushers which would break ice with little snow; crushers made of metal which would not rust; conveyors which were rust and abrasion proof; processing rooms, properly engineered with streamlined, automatic equipment; better and faster cubers.

Frozen Citrus Export Gains

EUROPE, despite rumors to the contrary, is a big market for frozen Florida citrus juices, says H. N. Baron, export manager of the Florida Citrus Exchange, Tampa, Fla. The exchange, Mr. Baron revealed, exported 6,400 cases of frozen juices to Europe and is negotiating another larger order to countries in the northern tier. There is more than ample refrigeration, he said, in Sweden, Switzerland, and Germany. Demand for frozen products is somewhat less in Central and South Europe.

These three countries alone have a combined population of some 60 million people, more than one-third that of the United States, Mr. Baron said. Orange is the most popular of frozen juices thus far exported, with the ratio running about three to one in favor of this product. Grapefruit juice is second. A recent exchange frozen juice purchase of 3,000 cases of 48 six ounce cans was made by the largest European buying cooperative representing over 4,000 stores.

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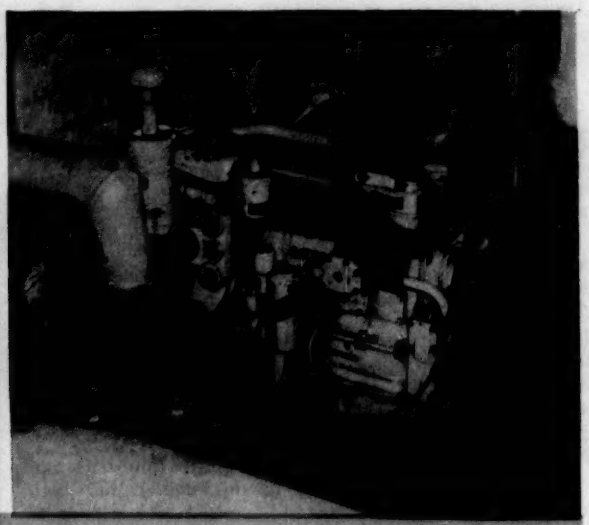

Switch to CAT* power proves profitable

for Fisherman's Ice Co., Inc.

In 1951, Fisherman's Ice Co., Inc., bought a Cat D13000 Engine for its plant in Valona, Ga. In 1953, the company added a D311. Production of ice averages 14 tons a day during the season. Jack Amason, Manager, speaks from experience with a total of ten Caterpillar Diesels, including D318s in six shrimp boats. He reports: "We tried three other makes before using Caterpillar Diesels. Since 1946, we haven't had a Cat Engine that made us regret switching."

In the plant, the D13000 drives a 7 x 7 compressor and a 5 x 5 compressor and a booster eight months out of the year. The other four months the D311 powers the 5 x 5 compressor and the booster for the freezer and storage. On maintenance, it takes two men only 15 minutes once every ten days to lubricate the equipment and change the oil and filters. "Cost of running Cat Diesels is cheaper than any other engine we've used," Mr. Amason says. "It's also cheaper than electric power here. The difference between the two will pay for the D311 in three years, as our D13000 has operated 18,760 hours without down time."

Low-cost operation, simple maintenance, minimum down time and prompt parts service when needed add up to money-making production in any plant. You can count on *all four*, using Caterpillar Diesels. What's more, they deliver honest power—the power promised is the power you get, an important factor when selecting a unit. For steady production at low cost, switch to a rugged yellow engine or electric set, available up to 520 HP and 315 KW. For proof of performance, see your nearby Caterpillar Dealer.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

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MODERN HEAVY-DUTY REFRIGERATION POWER

In the Spotlight

EFFECTIVE with this June issue, the Volume Index of Industrial Refrigeration is being published in the June issue of Volume 128. This is in accordance with previous practice and is being done to accommodate libraries and others who retain complete files and who find it more convenient to have the index in the last issue of the volume instead of in the issue following.

A LOS ANGELES grocery chain with the tremendously increasing demand for packaged frozen foods, felt a need for their own cold storage facilities. This resulted in design for a refrigerated plant 186 feet long, 140 feet wide, and 16 feet high, with an additional 20 x 60 feet for an engine room and a receiving and shipping dock 16 x 140 feet. Complete description of this new plant, with equipment and machinery, also, pictures, is given in the article starting on page 15.

A NEWLY Developed straight line processing machine for the frozen food industry has been put in operation at Shoreland Freezers Inc. Shoreland, Md. Designed to meet the need for a high-speed, automatic, and compact freezing unit, it will freeze up to 9,100 retail packages an hour in a continuous flow from wrapping machine to shipping case. For illustrated description of this new process, see article starting on page 18.

THE ASRE semi-annual meeting will be held at Milwaukee, Wisc. June 12-15. A diversified technical program will include formal papers on air conditioning and domestic refrigerators, and forums on diversified engineering subjects. See page 52.

STEEL PRESSURE vessels must have strength and toughness in order to withstand pressure at very low temperatures. A new steel produced by the United States Steel Corporation and fabricated by the Chicago Bridge & Iron Company into pressure vessels was given impact and burst tests to compare it with other vessels commonly used for such products. Details and results of the tests are given in the article on page 21.

THE GREAT LAKES Terminal Warehouse, built in 1927, was modernized in 1947 to permit installation of mechanical handling equipment. This is a good example of how a multistory warehouse, built before modern handling devices were available, can be made to accommodate fork lift trucks and pallets. See page 23.

STABLE TEMPERATURES have been obtained in a metal parts plant where close tolerances are necessary, with an air conditioning installation. The problems of metal expansion and contraction were thereby eliminated. See story on page 25.

THE PROBLEMS of shipping meats in refrigerator cars and the advantages of mechanically refrigerated units are discussed by a representative of John Morrell & Company, meat packers of Ottumwa, Iowa. When trains can be made up and rolled through to destination without delays, another major point will have been gained in delivery of the product, he says. See article starting on page 26.

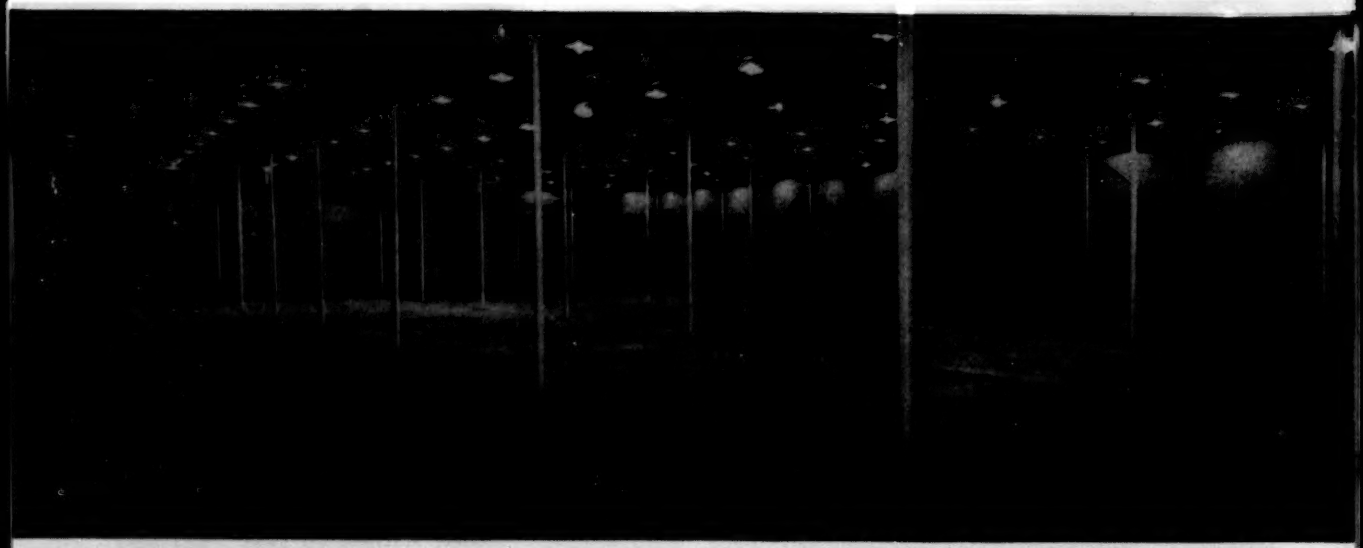
FROZEN FOODS, within the next five years, may account for nine percent of total grocery sales, providing the cabinet space problem can be solved.

A MATERIALS handling research project on handling apples conducted by the Washington State Apple Commission tested improved methods for using present equipment and introduced some of the newer types of materials handling equipment. For summary of report on this research study, see article on page 54.

PRACTICAL approach to selection of vapor barriers for cold storage structures is given in an article starting on page 34. The author, S. J. Stachelek, Toledo, Ohio, engineer, has developed a formula and chart for use in specifying Perm rating of vapor barriers and their placement, relative to the uses of the structure. Reverse vapor pressures, long a problem with porous or fibrous insulations, are no longer a "mysterious" phenomena when considered in the light of the author's explanations and recommendations.

NAPRE took another step forward in its avowed objective of education for the practical man in the industrial refrigeration field, when it sponsored, a Midwest Conference in Chicago April 30 — May 1. Six Chapters participated by sending delegates, speakers, or contributing papers. Several members-at-large were on the program. Four chapters contributed support although not represented by delegates. Five 50-year men of the industry selected by their chapters, were honored at the Saturday night dinner. For a review of the educational program and social events see article starting on page 40.

AN INDOOR ice skating rink has been installed in the gymnasium building of Middlebury (Vt.) College for varsity and intramural sports and general skating. Description of this modern skating rink and a picture of the piping used is included in the article on page 22.



In this 86' x 140' freezer room, seen here just after the CP refrigeration system had been installed, frozen foods are stored at a temperature of minus 10° F.

Exterior of Ralphs Grocery Company Frozen Foods Storage Plant showing compressor room and loading dock.

Another *Creamery Package* "PUSH-BUTTON" Cold Storage Plant

Ralphs Grocery Company, Los Angeles

When the Ralphs Grocery Company of Los Angeles decided to install its frozen foods storage plant, it wanted as nearly a "push-button" refrigeration system as it could get. Because of the nature of the operation, with an input of a quarter million pounds of frozen food daily, *some* supervision would be required, but it had to be held to a minimum.

The Creamery Package engineer was called in. Working with the CP engineering staff, he designed a refrigeration system for this big plant that is meeting all requirements and holding down supervision needs to the lowest level practical. Some idea of the scope of this operation can be had from the pictures shown here.

The full story could be told better by a CP engineer. If you have a refrigeration problem, why not call him in? You and he, together with the Creamery Package engineering group, may very well come up with some new answers to better refrigeration at lower cost.

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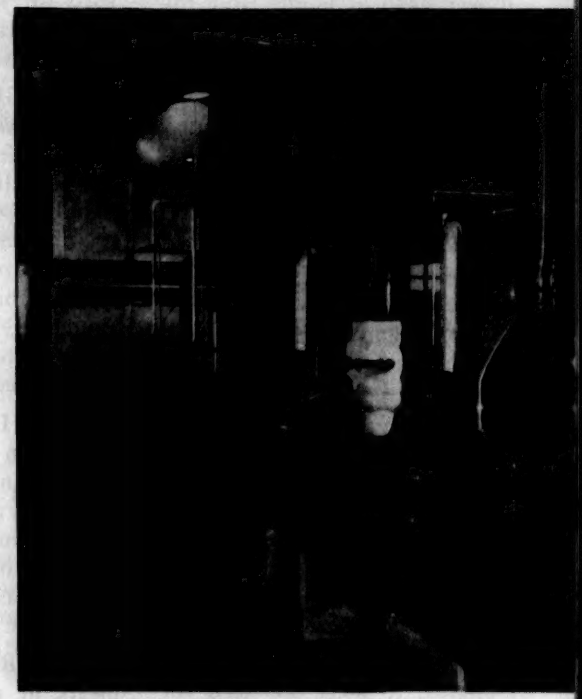
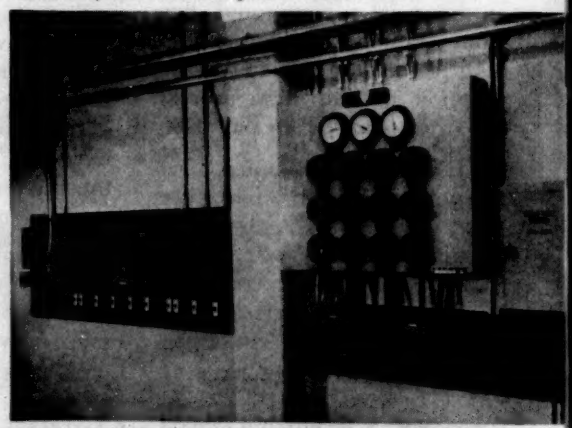


Here are two CP Type "K", 6 cylinder, 5 x 3½ boosters and two CP Type "K" 6 cylinder ammonia compressors. Also shown are the evaporative condensers. Discharge air from the condensers is stack-vented through the roof and provides ventilation for the compressor room during warm weather.



Control panel and gauge board of the CP refrigeration system at Ralphs Grocery Company. Under control of these gauges and switches functions a refrigeration system that is as automatic as

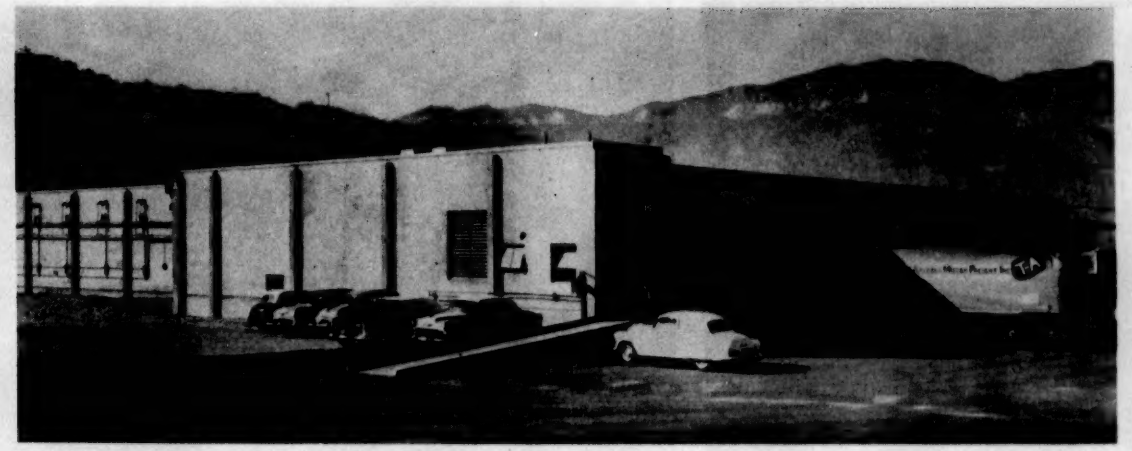


Fig. 1 — Ralphs' Frozen Food Storage Plant, Los Angeles. Exterior view of compressor room and loading dock.

Los Angeles Grocer Chain Builds Own Frozen Foods Storage Plant

Automatic system employs use of two-stage multi-cylinder ammonia machines, and ceiling type water defrost blowers.

K. V. BROWN
Sales Engineer
Creamery Package Mfg. Co.

WITH the tremendously increasing demand for packaged frozen foods, Ralphs' Grocery Company of Los Angeles long felt the need for their own cold storage. Operating 33 retail stores and already enjoying the advantages of their own grocery warehouse, milk and ice cream plant, bakery, fresh vegetable distribution, and a fleet of more than 150 trucks, the idea was conceived to build their own frozen foods storage.

An ideal location for such a building was a lot adjacent to the existing grocery warehouse. First, it was geographically a central point to the outlying retail stores. Secondly, considerable advantage could be realized through combined transportation facilities.

The lot available for this type of building was at the edge of a large ravine giving a natural drainage to the subsoil. It was necessary to make a fill to bring the ground to level. This solved the question of moisture turning to frost, causing floor heave. Some 1,000,000 cubic feet of fill material was used, with an additional 100,000 cubic feet used to bring the floor level at the dock side to average truck height. The height of the opposite side is level with a rail siding.

Refrigeration plant described in this article was engineered by the author, and installed under supervision of C. W. Roork, Los Angeles Branch, The Creamery Package Manufacturing Company.

Building Construction

Design called for a refrigerated plant 186 feet long, by 140 feet wide, and 16 feet in height on one side pitching to 14 feet, 6 inches on the other side. This is divided into two rooms, 86 by 140 and 100 by 140 feet, held at minus 10° F and 0° F respectively. The dividing wall is stud construction with 6 inches insulation, and a standard single hung 6 by 8 ft refrigerator door in the center.

The engine room adds an additional 20 feet by 60 feet along the side of the building, with the office in the front (See Fig. 1). Extending in front of the office is the receiving and shipping dock, 16 by 140 ft., which is insulated the same as the floor, in anticipation of future expansion.

Walls are of reinforced concrete, tilt up construction. Four inch pipe columns were placed on twenty feet centers each way, carrying steel I-beams. Cross rafters between beams formed the base for diagonally laid four-inch-thick t-&-g sheathing. Insulation was laid on top of the sheathing, topped by gravel roof.

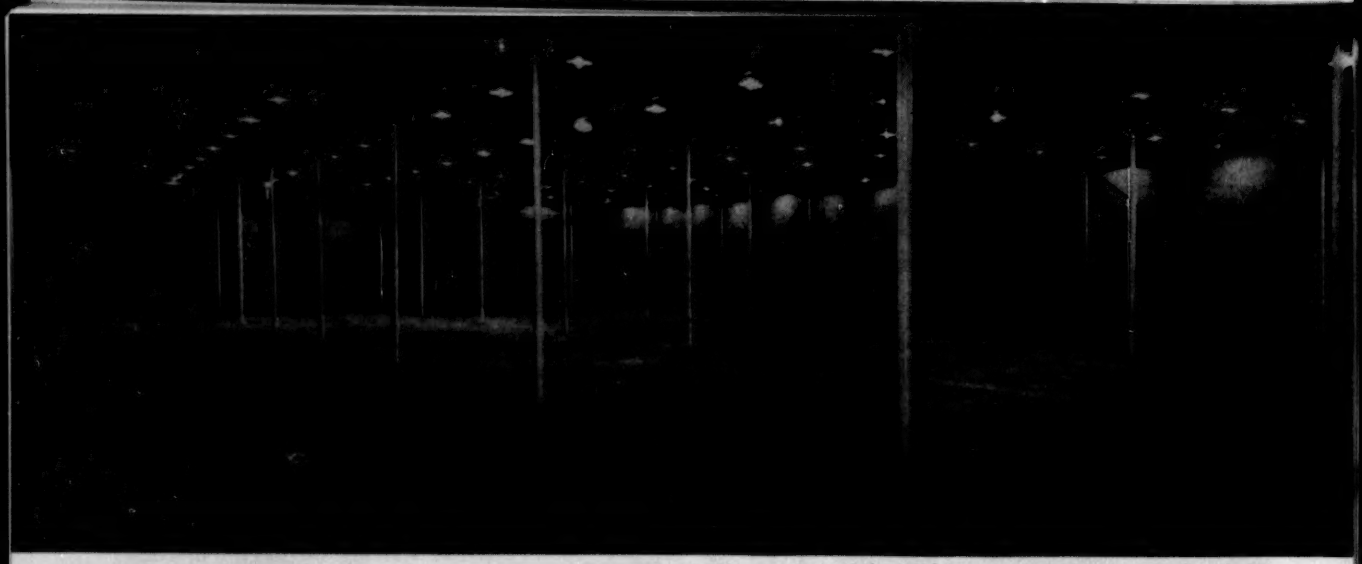
The refrigerated area is insulated with 8-inch thick J-M "Rock Cork" on the roof, walls, and in the floor, all applied by standard hot asphalt dip methods. All refrigeration piping, surge drums, etc in warm areas are insulated with extra heavy natural cork. Doors to the refrigerated rooms are single hung 6 by 8 feet high, opening into an entrance vestibule. Vestible doors are the flexible neoprene type, which allow quick passage of fork lift trucks.

Refrigeration Equipment

Refrigeration load included the heat gains from 63,000 sq. ft. of ceiling, wall and floor area, an extensive lighting system, and an average input of a quarter million pounds of frozen food daily. Two stage compression, and ceiling type water defrost evaporators were decided upon, since they offered simplicity of installation, flexibility and a minimum of maintenance.

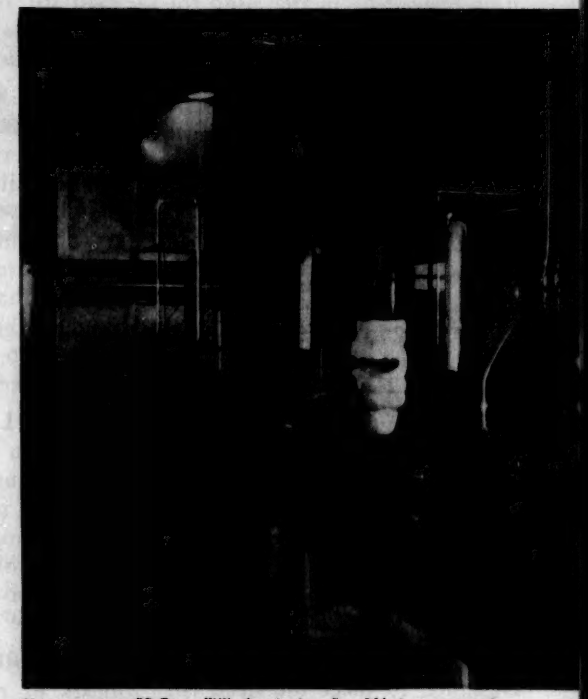
Equipment installed in the compressor room, (cover picture) are two Creamery Package, type "K", 5 by 3½ six-cylinder boosters, and two type "K", 3½ by 3½ six-cylinder ammonia compressors, equipped with 40 hp and 60 hp Fairbanks-Morse motors respectively. Also, located in the same room, is the 24 diameter by 12 ft liquid receiver, with a Phillips type "K" gravity liquid dump, mounted directly above. Condensing is handled by two model DFC-30A Recold evaporative type condensers, with desuperheat coils, installed in one end of the room. Discharge of air from condensers is vented by stack extension through the roof. This arrangement provides a venti-

Control panel and gauge board of the CP refrigeration system at Ralphs Grocery Company. Under control of these gauges and switches functions a refrigeration system that is as automatic as



In this 86' x 140' freezer room, seen here just after the CP refrigeration system had been installed, frozen foods are stored at a temperature of minus 10° F.

Exterior of Ralphs Grocery Company Frozen Foods Storage Plant showing compressor room and loading dock.



Here are two CP Type "K", 6 cylinder, 5 x 3½ boosters and two CP Type "K" 6 cylinder ammonia compressors. Also shown are the evaporative condensers. Discharge air from the condensers is stack-vented through the roof and provides ventilation for the compressor room during warm weather.

Another *Creamery Package* "PUSH-BUTTON" Cold Storage Plant

Ralphs Grocery Company, Los Angeles

When the Ralphs Grocery Company of Los Angeles decided to install its frozen foods storage plant, it wanted as nearly a "push-button" refrigeration system as it could get. Because of the nature of the operation, with an input of a quarter million pounds of frozen food daily, *some* supervision would be required, but it had to be held to a minimum.

The Creamery Package engineer was called in. Working with the CP engineering staff, he designed a refrigeration system for this big plant that is meeting all requirements and holding down supervision needs to the lowest level practical. Some idea of the scope of this operation can be had from the pictures shown here.

The full story could be told better by a CP engineer. If you have a refrigeration problem, why not call him in? You and he, together with the Creamery Package engineering group, may very well come up with some new answers to better refrigeration at lower cost.

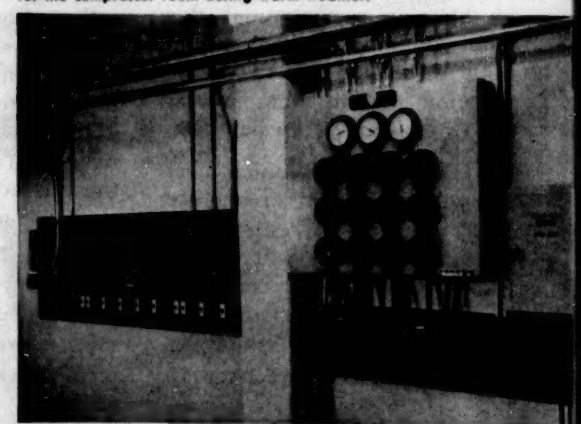
THE *Creamery Package* MFG. COMPANY

General and Export Offices: 1243 W. Washington Blvd., Chicago 7, Illinois

Branches: Atlanta • Boston • Buffalo • Chicago • Dallas • Denver • Houston • Kansas City, Mo. • Los Angeles • Memphis • Minneapolis • Nashville • New York • Omaha • Philadelphia • Portland, Ore. St. Louis • Salt Lake City • San Francisco • Seattle • Toledo • Waterloo, Ia.

CREAMERY PACKAGE MFG. CO. OF CANADA, LTD., 267 King St., West, Toronto, Ontario

THE CREAMERY PACKAGE MFG. COMPANY, LTD., Mill Green Rd., Mitcham Junction, Surrey, Eng.



Control panel and gauge board of the CP refrigeration system at Ralphs Grocery Company. Under control of these gauges and switches functions a refrigeration system that is as automatic as

Fig. 1 — Ralphs' Frozen Food Storage Plant, Los Angeles. Exterior view of compressor room and loading dock.

Los Angeles Grocer Chain Builds Own Frozen Foods Storage Plant

Automatic system employs use of two-stage multi-cylinder ammonia machines, and ceiling type water defrost blowers.

K. V. BROWN
Sales Engineer
Creamery Package Mfg. Co.

WITH the tremendously increasing demand for packaged frozen foods, Ralphs' Grocery Company of Los Angeles long felt the need for their own cold storage. Operating 33 retail stores and already enjoying the advantages of their own grocery warehouse, milk and ice cream plant, bakery, fresh vegetable distribution, and a fleet of more than 150 trucks, the idea was conceived to build their own frozen foods storage.

An ideal location for such a building was a lot adjacent to the existing grocery warehouse. First, it was geographically a central point to the outlying retail stores. Secondly, considerable advantage could be realized through combined transportation facilities.

The lot available for this type of building was at the edge of a large ravine giving a natural drainage to the subsoil. It was necessary to make a fill to bring the ground to level. This solved the question of moisture turning to frost, causing floor heave. Some 1,000,000 cubic feet of fill material was used, with an additional 100,000 cubic feet used to bring the floor level at the dock side to average truck height. The height of the opposite side is level with a rail siding.

Refrigeration plant described in this article was engineered by the author, and installed under supervision of C. W. Roork, Los Angeles Branch, The Creamery Package Manufacturing Company.

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Fig. 2 Above — Compressor Room, showing Evaporative Condensers, two CP 6-Cyl. 2nd Stage Compressors, two CP 6-Cyl. Booster Ammonia Compressors, Suction Trap, Intercooler, and associated piping.

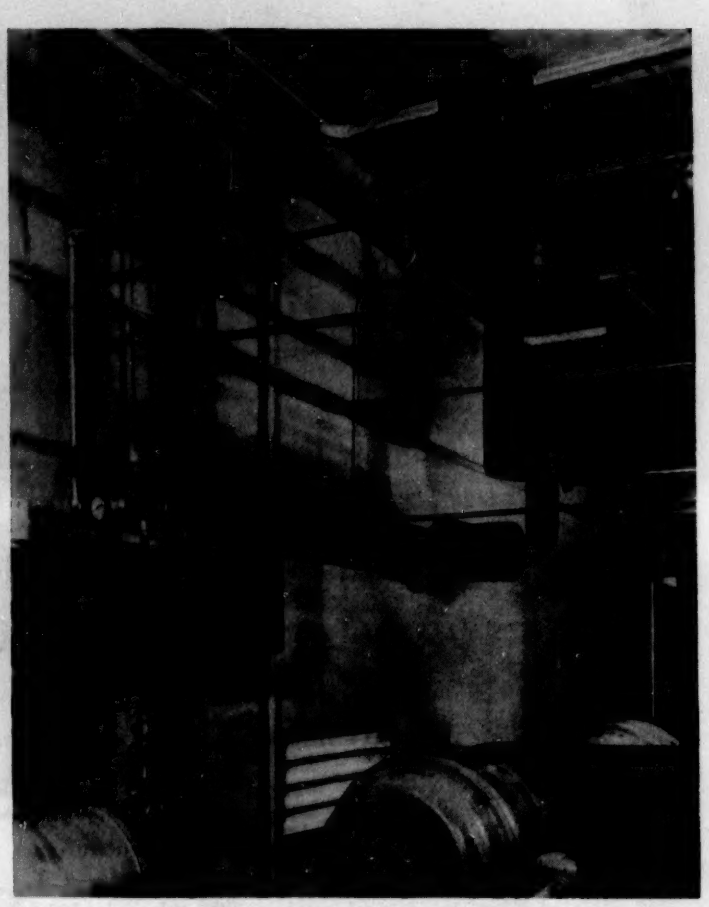


Fig. 3 Right — View of low pressure suction accumulator and Phillips liquid return system.

lation system for the compressor room during warm weather.

As shown in above picture, the intercooler is located near the center of the room between the boosters and the compressors. Directly above the intercooler is the main 5-inch suction header and the 30-in. x 5 ft. suction trap, connected integrally with the liquid dump (See Fig. 3). Room for a future installation of another set of machines was provided, and space left on the panel board for their controls.

Oil Trapped at Two Points

Automatic oil return for the boosters is taken from the intercooler. Oil is also returned automatically to the high stage compressors, being separated from the discharge gas after the gas has passed through the desuperheat coils of the condenser; before the gas enters the main coil bank for final condensing and cooling. Condensers are cross-connected and valved so that either one can be used with any machine running. Each machine is equipped with oil failure switches to cut power if oil

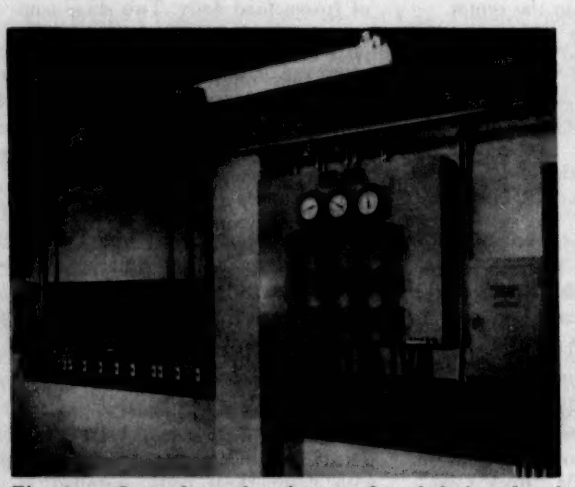


Fig. 4 — Control panel and gauge board designed and installed by the Creamery Package Mfg. Company. Time clocks and defrost controls are at left. Group at right controls system high side and accessories.

Fig. 5 — Recold water defrost evaporators in 0° F rooms, Ralphs' Frozen Foods Storage Plant, Los Angeles. Note pipe column roof beam supports and turnbuckle type bracing.

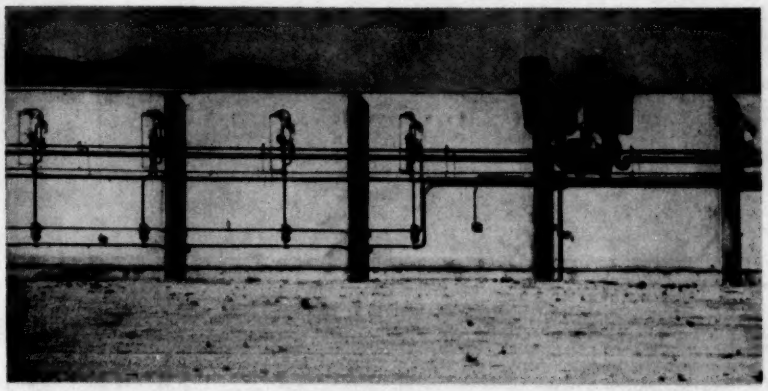


Fig. 6 — Unusual arrangement of electric service and controls for blower coils, water supply and drain lines, and NH, surge tanks, mounted at side of plant for accessibility to maintenance personnel.

pump should fail, or if oil level lowered beyond safe operation.

Duplicated Plant for Standby Safety Measure

The plant was designed for one set of machines to maintain temperatures with a normal input load. A second set was installed as an added safety measure, and would start automatically should the occasion arise to double the product load.

Instrumentation for the equipment includes twelve Mercoid pressure switches (Fig. 4). There are three for each machine: (1) high pressure cut out, (2) low pressure start-stop control, and (3) low pressure 50 percent capacity control. All pressure switches, controls and thermostats operate relays, and make no direct contact with a line voltage circuit. This precaution was taken to insure a continuous operation, uninterrupted by burned contacts.

The entire instrumentation is electrically connected with an ADT warning system, setting off an alarm if anything of a serious nature should occur. If a low pressure switch fails to start the motors, or if a machine cuts out on high head pressure, a relay sends the message to the warning system. Also, any undue rise in temperature in the refrigerated room will sound a warning. Similarly, an electric float switch for high liquid level is mounted on the suction trap, and automatically cuts all power to the machines, sounds a warning horn, and sends its message for help. This condition would only exist if the liquid dump failed.

The water pumps on the condensers operate when the condenser corresponding compressor starts, thus keeping a wet coil. Fans, which are the dry type are energized simultaneously but are connected in series with a water thermostat. This arrangement has been found to control the head pressure within a range of three to five pounds.

Low Side Equipment

Design temperatures and estimated product load called for the use of ten model AS2900LT Recold water defrost blowers, mounted five on each end of the minus 10° F room (Fig. 5), and seven mounted four and three in the 0° F distribution room. These are equipped with three 1/3 hp fans each, and have a throw of 70 feet. Tests have shown even temperatures throughout each room. There are no warm spots, temperature-wise, nor are there any dead spots, air distribution-wise.

Each bank of blowers is equipped with a specially designed vertical surge drum, giving two individual systems for each room (Fig. 6). The surge drums are all connected through service valves to a common four inch header running the entire length of the building. The evaporators are full flooded by liquid at suction pressure saturation temperature. Liquid level and feeding of fresh liquid is maintained by Sporlan "Level-Masters".

Most unique about this type of installation is that all controls are located in warm areas. Also, it should be noted that if one bank of blowers should be out of service for maintenance, reasonably good temperatures can be obtained from the other bank in the same room. This arrangement is also an aid in defrosting.

Defrosting Automatically

Since the entire system was designed to run completely automatic, a defrost system as nearly infallible as possible was mandatory. Dependability of city water supply and pressure in the area was questionable and created a temporary problem as 20 gpm is required to defrost each unit. The possibility of a failure was minimized by separating the units, so that not more than three would require water at any given time.

Controls selected for this all-important job were seven model W-24 Paragon 24-hour timers, set to go through their cycle when the normal consumption of city water is at a minimum (refer to Fig. 4). Sequence of operation for each bank of blowers is: (1) refrigerant solenoids close, (2) fans off, (3) water on for a given time interval, (4) delay for draining, (5) refrigerant solenoids open, and, (6) fans on. Compressors continue to run, holding room temperature with the second bank of blowers. There is a separate timer for each set of three or less blowers to prevent defrosting the entire bank at one time. The clock of any one timer is set a few minutes ahead or behind that of another.

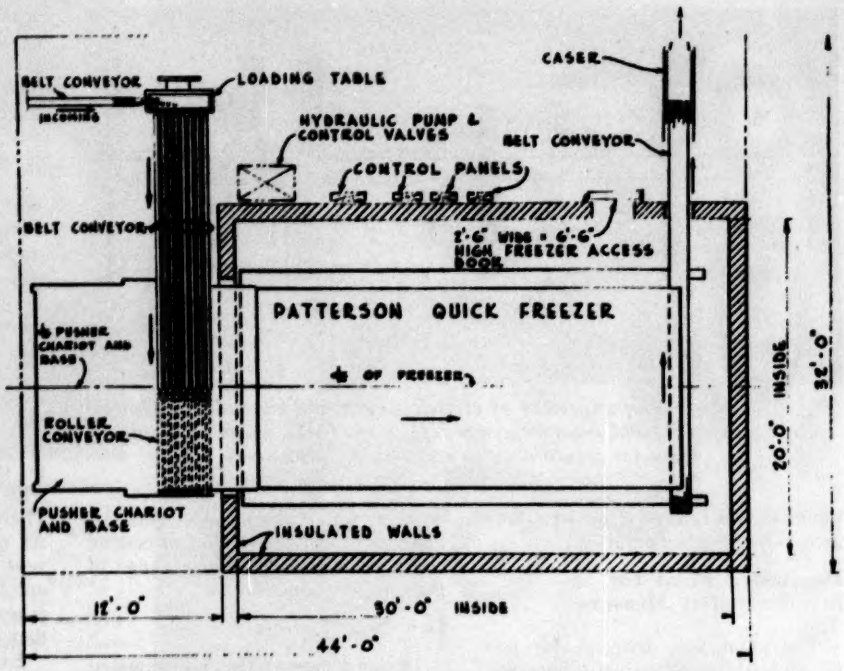
Experience has shown that very seldom it is necessary to defrost every 24 hours. In order to conserve water and reduce the cost of defrosting, a 7-day master timer was installed to operate a relay. This relay energizes the defrost cycle. It is possible to defrost either every 24 hours, or any day or combination of days selected.

Unit Precautionary Controls

To insure maximum safety in the operation of a fully automatic water defrost system, a number of measures were taken. Each blower is individually equipped as if it were an entire evaporator system. Float switches were installed in each drain pan to close the water supply solenoid valve in the event the drain became plugged. The remaining blowers in that particular bank would continue the full defrost cycle. A water pressure switch was installed in the water supply line. This switch prevents the operation of the fans of that particular blower, in the event the water supply solenoid valve failed to close.

Failure of any blower to complete the defrost cycle will not prevent the balance of the blowers from operating. Tests have shown that several blowers can be demobilized with no appreciable change in temperature. It is only necessary for a maintenance engineer to inspect the operation occasionally. Units failing to defrost would be quickly noticed, and proper steps taken to remove the cause of trouble. With all controls in a warm area, the engineer can make the necessary repairs in comfort.

(Continued on Page 56)

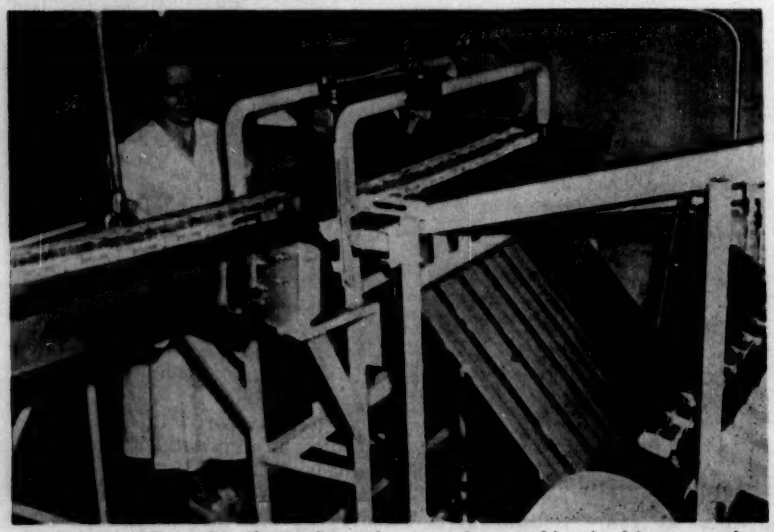


Floor plan of Patterson continuous plate freezer. Retail packages arrive at upper left, are separated onto eight levels on the pusher chariot. Rows then are pushed through insulated slots into the freezer proper. Progress of packages is toward the right. Frozen packages are carried to the automatic caser, upper right. Arrows indicate product flow.

Contiunous Plate Freezer Speeds Up Processing of Frozen Foods

THE first unit of the Patterson Continuous Plate Freezer, a newly developed straight line processing machine for the frozen food industry, has been put into successful operation at Shoreland Freezers, Inc., Shoreland, Md. The new processing machine, designed to fulfill the Industry's need for a high-speed, automatic and compact freezing unit, will freeze up to 9,000 retail packages per hour, according to the builders.

This is the first continuous plate freezer developed to handle the output of a high speed wrapping machine. Also, it is the only freezer which incorporates its own casing machine to produce a continuous flow of packages from the wrapping machine to the shipping case.



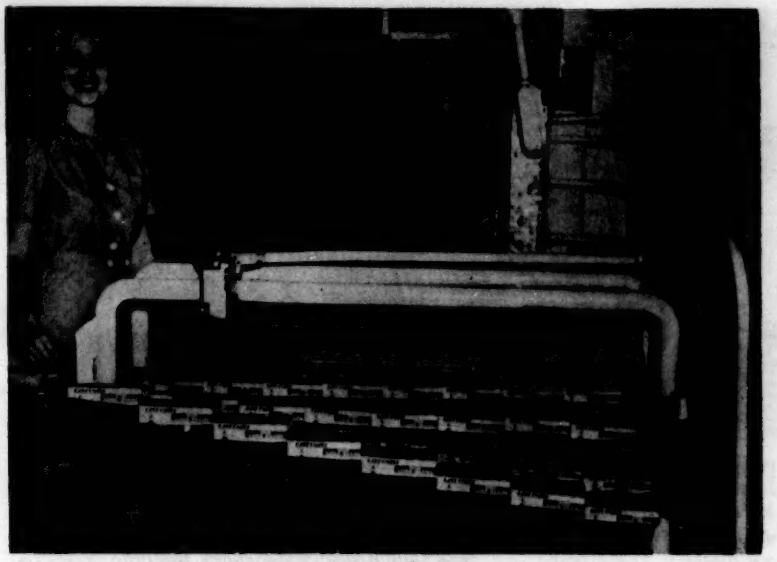
A continuous line of packages from the wrapping machine feed in across the counting table and operate a limit switch located at the end of the line. In this view the limit switch has just operated and eight packages are being transferred to the eight levels.

Machine Capacity

The machine holds 14,000 standard size retail packages in the process of freezing at the same time. A package $1\frac{3}{8}$ inch thick moves through in less than one hour and thirty minutes. This compares with the blast tunnel type method which requires more than three to four hours, plus handling time. The Continuous Plate Freezer combines speed, efficiency and economy, says V. C. Patterson, the inventor. The freezing is converted from a more or less batch operation into a high speed, automatic process, followed by automatic casing."

Freezing Section

The freezing section is approximately ten feet high, fifteen feet wide and twenty-five feet long. It is enclosed in a special room or cell approximately 12 feet high, 20 feet wide and 30 feet long. There are eight freezing levels, with an upper and lower plate to each. This provides approximately 4,000 square feet of refrigerated surface contacting the packages, plus another 4,000 square feet on the opposite or off-



The incoming line of packages is pushed onto the eight conveyor belts which fan out to eight loading levels.

contact side of the plates. Because prime surface plates are used, the plate surface temperature is approximately the same as the refrigerant temperature. In an air blast tunnel, by contrast, it is claimed, there is a wider divergence of temperatures.

The problem of defrosting has been virtually eliminated since the packages enter the freezer through openings that are air conditioned to reduce infiltration and thereby reduce frost formation on the off-contact side of the plates. The movement of the packages over the contact surfaces keeps them relatively clean.

Development

This freezer represents the culmination of twenty years of planning, experiments and development by Patterson. During that time he developed an air blast tunnel freezer using trucks and trays, the continuous vertical column freezer for loose products and the first continuous package food freezer using air blast. Still determined to perfect a more efficient machine, he began early in 1952 to work out ways and means to produce continuous automatic handling and freezing of packaged products by using the efficient and accepted plate method.

The inventor and engineer organized Patterson Freezer Corporation in 1953 and contracted with Shoreland Freezers, Inc., early in 1954 for the installation of the first continuous freezer complete with automatic caser. The first freezer was designed, manufactured, installed and put through operating tests before the end of the 1954 packing season.

How it Works

Freshly filled packages of fruits or vegetables flow continuously and automatically from the wrapping machine, through the freezer and on into the shipping case.

The continuous freezer consists of four major sections: The infeed, The plate freezer, The package discharge, The package caser. With the exception of the belt infeed for the freezer and the belt infeed for the caser, this freezer is hydraulically operated and is electrically timed to produce continuous operation.

The infeed section, located outside of the refrigerated room, delivers the packages in a single line to a counting and distributing station where they are transferred in groups of eight to belts which in turn line them up in front of the freezer inlets on eight levels.

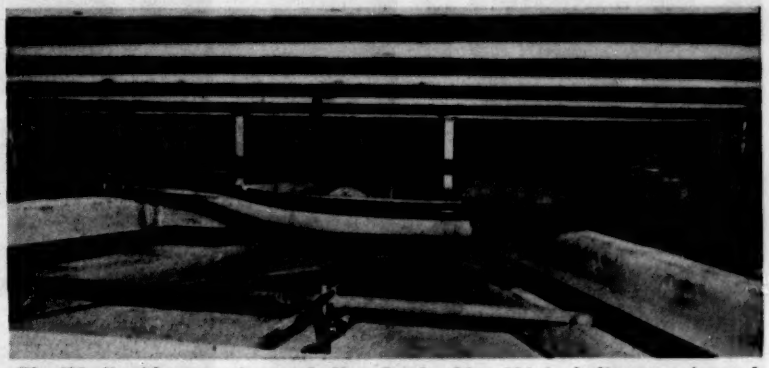
When 280 packages have accumulated in front of the freezer, they are pushed into the freezer as the plates open up. The packages are frozen between refrigerated plates under pressure to produce flat packages. There are eight levels of movable plates on which the packages rest and eight fixed upper plates which contact the top of the packages when the freezer closes. The movable plates are mounted in a common frame supported on four wheels which roll on cam tracks. It is the forward and back movement of this frame on the cam tracks that opens and closes the space between the fixed and movable plates.

Packages Into Freezer

When the freezer plates have opened up, the unfrozen packages are fed in over holding plates. It is the curbed edge of these holding plates that prevents the packages moving back when the movable plates close. Each time the plates open the packages are advanced one row and so move through the freezer. By the adjustment of one screw on each of the four cam tracks this freezer can be adjusted to handle packages ranging from $\frac{7}{8}$ to $2\frac{1}{4}$ inches in thickness.

When the freezer is completely filled, each new incoming line forces a line of frozen packages to discharge on each of the eight levels. The frozen packages then are transferred out of the refrigerated room on eight levels to the belts that feed the automatic caser. In order to case four packages high, it is necessary to converge the eight levels into four levels. This action takes place outside the refrigerated room.

The first Patterson Continuous Plate Freezer was manufactured by The Oliver Corporation in York, Pa.



Flexible liquid ammonia supply line. Steel tubing $1\frac{1}{2}$ inch diameter, formed into a double expansion bend, is hung between bottom plate and movable framework and takes the place of the customary rubber hose. Top edge of large hydraulic cylinder, which opens and closes machine, can be seen in center of picture.

The bank of eight movable bottom plates have just moved forward (to left in picture) and received an incoming row of 35 packages, which have entered through the port, lined up on the top level, waiting successive cycles to move into the area between plates.

Flexible suction line — header and valve for movable framework which supports bottom plates, are shown in left rear. Suction manifold and lines, consisting of six 2-inch steel tubes formed into double expansion bends, are shown supported above machine.

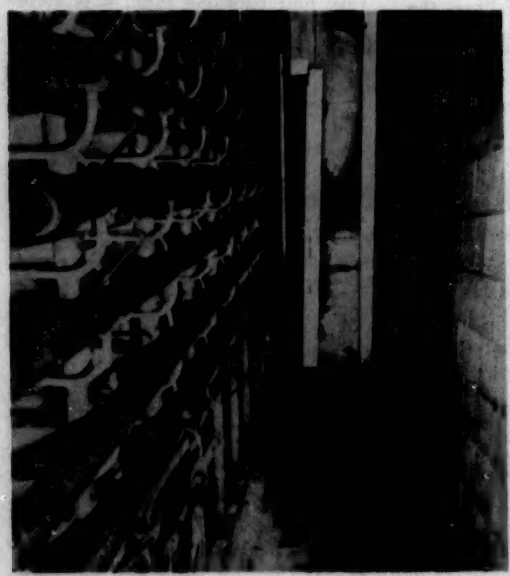
The refrigerated plates were furnished by Dean Products in Brooklyn, N.Y. Inlet conveyors and caser were manufactured by The Spivey Company, Philadelphia, Pa.

Shoreland Freezers

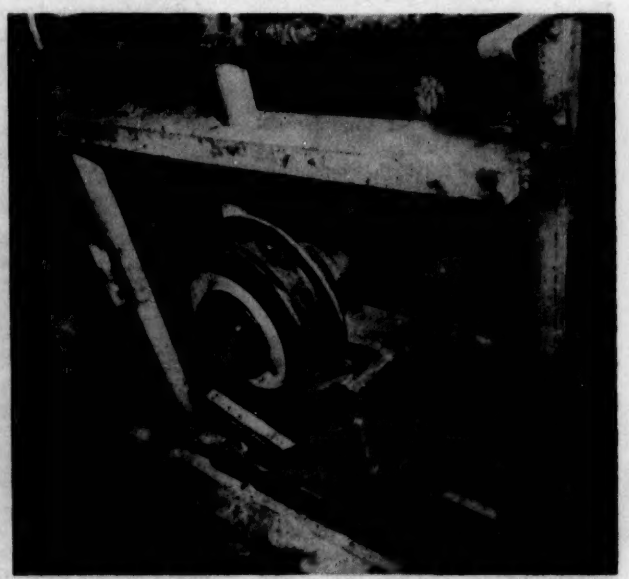
Shoreland Freezers, established in 1946 employs approximately 260 people during the peak production period and operates eight to nine months of the year. The plant at Salisbury has grown steadily until it now includes 14 acres of land and 43,100 square feet of buildings. This represents a total investment in the neighborhood of $600,000.

There are three distinct refrigeration systems. The first is the "cooler system" which maintains a 60,000 cubic foot chill room as 35 F for temporary storage of vegetables fresh from the field and a 40 gallon per minute water cooler delivering 35 F water for final washing of the processed vegetables before they are packaged. The "freezing system" utilizes two-stage ammonia compression to produce temperatures of minus 40 F in two blast freezing tunnels and the continuous plate freezer, which together have a capacity of 200,000 pounds every 24 hours. The "zero storage system" maintains minus 5 F temperature in three storage rooms where finished merchandise is held awaiting shipment.

Shoreland concentrates on packing merchandise for nationally advertised, regional, and chain store brands. This market absorbs more than half the total production. The company's institutional business is of almost equal importance. This merchandise is packed mainly under three labels, "East Coast", "Shoreland", and "Snow Hill Farms", and during the last year they have introduced their own retail line of frozen vegetables under the "East Coast" label.



Side view of machine, showing liquid ammonia and suction headers with connections to freezing plates.



Exact space between the fixed and movable plates is adjusted by raising or lowering the four tracks, one of which is shown above.

Dry Ice and Brine Refrigerants Used For Low Temperature Carilloy Tests

E. N. ZIMMERMAN
Chicago Bridge & Iron Co.
Chicago, Ill.

MANY steels fail in a brittle manner at sub-zero temperatures. Therefore, strength and toughness of steel of pressure vessels is tested in these modern times at well below zero temperatures. A demonstration of such testing at minus 45 F took place in mid-1954, at the Birmingham plant of Chicago Bridge and Iron Company, when that firm and the United States Steel conducted "Operation T-1".

Carilloy a new steel produced by USS, was fabricated by Chicago Bridge and Iron into pressure vessels. In "Operation T-1" they underwent impact and burst tests in order to compare the new material with those steels commonly used for pressure vessel construction.

Composition of Carilloy is similar to other steels except in the alloys added, which are less than three percent. A special heat treatment of quenching and tempering adds to the toughness and strength built-in by the alloys. Tests indicated that the outstanding characteristics of *Carilloy* is its strength, being three times as strong as mild or carbon steel. It retains its toughness at temperatures far below the tests and up to 900 F as well. A definite advantage is the lighter weight. Conclusions drawn from the test, indicate *Carilloy* steel in pressure vessels would require less thickness and no stress relieving.

Test Procedures

Two types of tests were conducted on *Carilloy* vessels; one a burst test under hydro static pressure, the other an impact test. Refrigerated brine was used to lower the temperature of the vessel. The vessels themselves were constructed of half-inch *Carilloy*, 4 ft. in diameter by 20 ft. long over the spherical heads (see Fig. 5). Eight vessels in all were tested, four being preliminary.

In the final test two of the vessels were stress-relieved and two were not, vessels 1 and 2 being non-stress-relieved. Burst tests were conducted on vessels number 1 and 3 (See Fig. 1 and 3). Refrigerated brine in these vessels was raised to 2850 psig before rupturing. In both vessels the render was a tear, a 45 degree shear, rather than the explosive burst that might be expected. The nominal stress at the point of failure was 136,900 psi.

A new method for testing full scale vessels was used for the impact test. A 13.8 ton steel ingot was dropped from various levels of a 149 foot tower on vessels 2 and 4 (See Fig. 2 and 4). These tanks were under 1875 psig, twice their design strength. At 52 and 73 foot drops, the ingot failed to shatter the vessel; the 73 ft. drop only denting the tank slightly. A 10 story drop (101 feet) did the trick with an impact of 2,700,000 ft-lbs. (80.5 ft. per second).

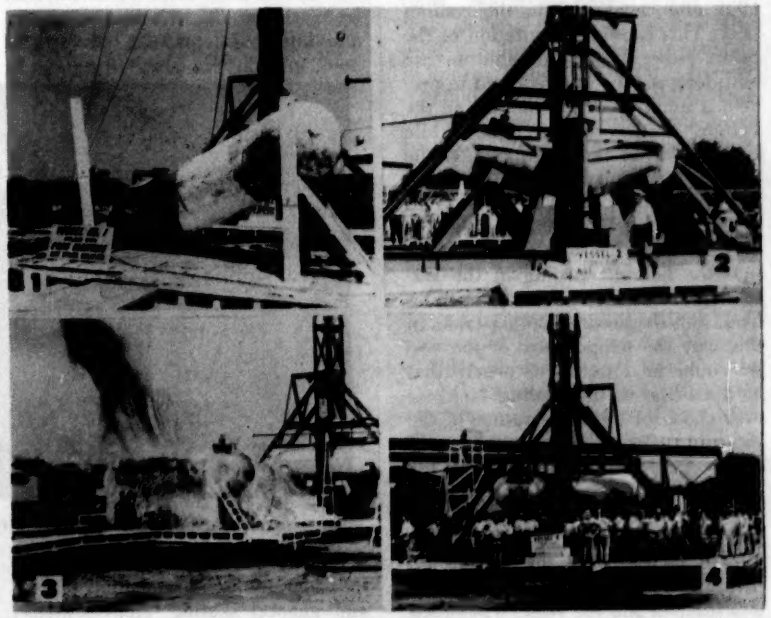
There was no difference in the bursting pressure or the shattering due to impact to vessels which were stress-relieved and those which were not. This led engineers to the conclusion that stress-relieving with *Carilloy* is unnecessary.

Refrigeration

Test vessels used were cooled to minus 45 F. Testing temperature was determined by the means available to obtain sub-zero temperatures. Over 8,500 gallons of calcium chloride brine were required for the two-day test period to fail four vessels. Each vessel had a volume of 1755 gallons. The cooling tank was 10 feet in diameter and approximately 6 feet deep. In order to obtain the low temperature of the brine without solidification, it was necessary to mix a solution having a specific gravity of exactly 1.29.

Brine Mixed in Batches

The brine was mixed in batches in the cooling tank by first measuring in the quantity of water, and then breaking open 100 lb. bags of treated calcium chloride and dumping it down the chute shown in Fig. 6. Calcium chloride was held at the center of the liquid by the screen at the end of the chute. Since the cal-



Pressure vessels of Carilloy tested in 1954 at minus temperatures to determine strength and toughness of this new steel. Fig. 1 (top left) Shows non-stress-relieved vessel which burst at 2850 psig. Fig. 2 (top right) Shows non-stress-relieved tank at conclusion of impact test. Fig. 3 (lower left) View of stress-relieved vessel at moment of rupture. Fig. 4 (lower right) View of viewing stress-relieved tank under 1875 psi between 2nd and 3rd impacts.

All photos, courtesy The Water Tower, house organ, Chicago Bridge and Iron Company.

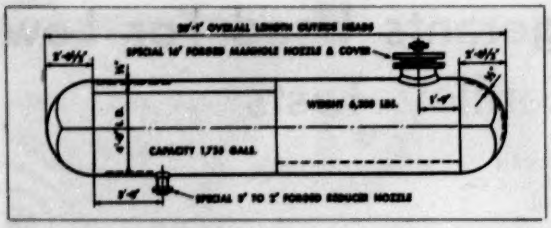


Fig. 5 Above—Design of Carilloy T-1 vessels, is not unlike receivers in refrigeration plants. New material has three times strength of carbon or mild steels used for pressure vessels.

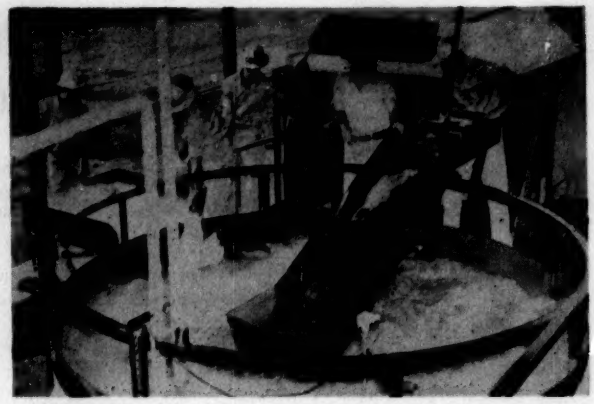


Fig. 6 Right—Chicago Bridge and Iron employees breaking blocks of dry ice and immersing in calcium chloride brine to lower temperature to minus 55 F. Ingredients: 6800 gal. H_2O, 34,800 lbs. Ca Cl, 40,000 lbs dry ice, for 8500 gals. brine.

cium chloride, when mixed with water, became heavy, it fell to the bottom and started a natural circulation. The brine was also agitated by raising and lowering the chute.

When the brine had been mixed, the temperature was raised to approximately 120 F. Therefore, the brine was mixed ahead of time and allowed to cool to atmospheric temperature. As the brine was mixed it was pumped into and stored in the test tanks. A 6,800 gallons of water and 348 — 100 lb. bags of treated calcium chloride were used to obtain the required 8,500 gallons of brine.

Brine and Dry Ice Mixed

Two days before the test, blocks of dry ice were broken with hammers and shoveled into the cooling tank. This caused an agitation of the brine. However, considerable mixing with long scoops was required to prevent a build-up of the dry ice on the bottom of the cooling tank. While cooling within the mixing tank, the circulating pump alternately pumped the brine from bottom to top or from top to bottom. When cooling the test vessels, the brine was pumped back into the bottom opening of the vessel and forced out the top opening back into the mixing-cooling tank. In this way the temperature of the vessel could be lowered to nearly that of the brine in the cooling tank.

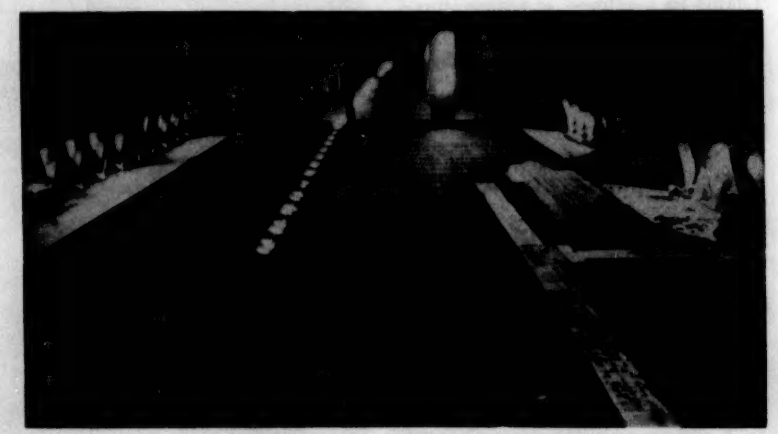
A check of the temperature of the returning brine was made and thermocouples were applied to the heads of the test vessel. Both of these values were used in determining the actual temperature of the steel at the time of the test. When the proper temperature was reached, the circulation was stopped and the vessel was closed off at the top. The valve system was then changed to permit application of a high pressure pump to force the cold brine from the cooling tank into the vessel under test. As the pressure was increased, considerable care was taken to bleed off any air or gas that might collect in the vessel.

Over 40,000 lbs of dry ice was required to reduce this quantity of brine to minus 55 F and to cool the four test tanks down to the minus 45 F test temperature. Once the cooling had started, a crew kept adding dry ice to maintain the low temperature.

The cooling tank itself was insulated. However, the tanks were not except when the frost formed on the outside of the vessel. Sodium dichromate was added to the bags of calcium chloride as a rust inhibitor. This gave the brine a yellow color which was very effective in the testing and for color photography.

College Ice Skating Rink Provides Floor For Varsity and General Sports

A NEW indoor ice rink has been installed in one end of the field house and gymnasium building of Middlebury College, Middlebury, Vermont. The first artificial ice rink in Vermont, it is use for varsity and intramural hockey, the carnival ice show, physical education classes, and general skating. Approximately ten miles of steel pipe, made by the Spang-Chalfant Division of The National Supply Co., carries the refrigerant to create the 85 foot by 185 foot ice surface.



Pipe installed in Vermont's first ice rink at Middlebury College.

The refrigerating equipment permits all year enjoyment of ice skating regardless of the temperature outside. The 1-inch black pipe is laid on 4-inch centers. Each section of pipe forms a long loop, extending from the line to a hairpin bend at the opposite end of the rink, and then back to the return header. The lengths of pipe are welded together and are supported on ½-inch steel pipe on 6-foot centers. The Creamery Package Mfg. Co., Boston, installed the refrigeration equipment and the Boston Pipe and Fittings Co., Cambridge, Mass. provided the Spang Pipe.

Modernizing the Older Multi-story Warehouse

L. M. ASHENBRENNER.
Great Lakes Terminal Warehouse Co.
Toledo, Ohio

MULTI-STORY warehouses are usually housed in buildings constructed 20, 30 or 50 years ago, in congested areas, with limited amount of dock space. When planning mechanization of such a warehouse, first consideration should be given to size of elevators (car area) and then capacity. The elevator is considered an aisle the same as an aisle in a room, except that one is vertical and the other horizontal. Elevators should have a minimum capacity of about 5,000 pounds. Other factors to be taken into consideration are the size of rooms and ceiling heights, including space required for sprinklers. Door openings should be 54 inches wide minimum, 60 inches preferred, depending on the size of pallets used.

The Great Lakes Terminal Warehouse at Toledo, Ohio. This warehouse, built in 1927, was modernized in 1947 to accommodate mechanized handling equipment.

Warehouse Built 1927 Modernized 1947

Our warehouse was built in 1927. We started modernizing it in April 1947, and considerable improvement in mechanized handling has been made since that time. Manufacturers of handling equipment have gained experience from early users of this type of equipment, which was costly to the early users, but more adaptable equipment is now available. When installing mechanized handling in an older warehouse, loss of aisle space is an important consideration; we use 6-ft. aisles.

Mechanization depends on the type of warehouse and the area it serves. In a distribution area and with heavy turnover, palletization is preferred. In production areas where products stay in storage for long periods, hand piling may be preferred because it permits close piling and provides more storage revenue per square foot. But a disadvantage is that this method entails a relatively high labor cost. For small rooms also it may be advantageous to use the hand method. In high ceiling rooms, the use of staking irons may be advisable, to prevent crushing of products. Our ceilings are 10 ft. 4 inches. We do not use racks.

From paper presented at NARW-TRRF Training Conference, Chicago, Ill., January 10.

Walkie Equipment Used

Because of a considerable variation in types of buildings, there are no set rules for proceeding with modernization. Each house must adapt a plan of its own after a careful study of all the factors involved. We use all walkie electric equipment. Dollies are equipped with drop-down adapter, which will also handle our skids, which are 7½ inches off the floor and measure 3 x 5 feet. Our electric trucks weigh 1100 to 1500 pounds. Stacking or hi-lift units are the outrigger type which weigh 1900 to 2200 pounds. They stack 93 inches high and can be taken on elevators with loads. We are able to take loads off of elevators without any extra stacking machines in the rooms. Counterbalance walkies for the dock, cars and trucks used mostly for cars, weigh 3600 pounds and lift a 3000 pound load.

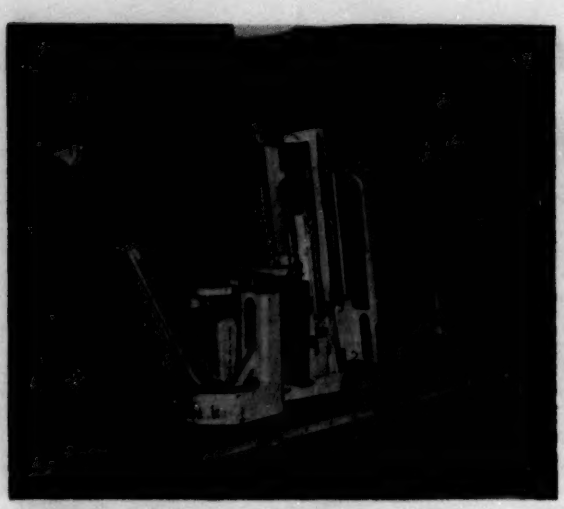
The trend, I am advised, is to rider type equipment, which is heavier. We tried this type, but installed the walkies because our help preferred them. We are, however, giving further thought to installing some rider type equipment, but one drawback is that this type is heavier and will not work well with our elevator capacity.

An advantage of the walkie type equipment is that it can be operated by anyone with a little experience. The hi-lifts we use do not require a special fork-lift operator, although it is important that the man doing the stacking knows how to conserve space. Some men can do a better job when using the hi-lifts, keeping the aisles as small as possible and stacking closer.

We have 22 walkies, 10 hi-lifts, and two counter balanced units. We have 22,000 wood four-way pallets, 36 x 48 inches. Our total handling equipment investment is approximately $130,000, of which $50,000 is for pallets and the balance for equipment, chargers and extra batteries. We believe strongly in having plenty of equipment, so as to have replacement in case of breakdown or repairs.

Batteries

On our new equipment we use an 18-volt battery, which provides more power and longer runs, but requires a different size charger than for the 12-volt batteries in use on the older equipment. We have four bank chargers and single chargers, but prefer the single type. Re-charging of batteries is done at noon. It costs approximately 15 cents a day to charge a battery, about $1500 a year. Maintenance is about $400 a month, or $5,000 a year. However, with experience, we have been able to reduce our maintenance costs considerably. Many of our batteries are seven years old, and we have only lost ten since we started using them in 1947. Although our city water is approved for such use, we use distilled water.



Unloading from car with walkie electric truck.

An aisle in Merchants Terminal refrigerated storage room showing boxed goods stacked to ceiling.

The engineer on night duty sees that all batteries are fully charged, and on Sundays we give them any extra charging needed, which helps to keep them in good running order.

Each man is assigned his own equipment, based on our findings that they keep their own equipment in better shape and there are fewer breakdows. They are very jealous of their own property, and will allow others to use it only under protest.

The equipment is oiled and greased on Saturday mornings. The grease we are using currently costs 33 cents a pound. It has a very low and also a high temperature test, and has been very satisfactory. We are well pleased with this electric equipment. It is clean in operation and works quietly.

Pallets

We have standardized on one size pallets, 36 x 48 inch wing type. We have thought sometimes that the size 40 x 48 would have been better, but the larger the pallet the larger aisle space is necessary, and this is important when it is desired to conserve this space. One of our problems in this connection is that of pallet interchange, with varying sizes of pallets coming in. I would recommend that some study be made of this problem, toward more size standardization.

I also want to mention in this connection a new type metal bottom pallet, which weighs less and is stronger. Our use of these has been only on an experimental basis. Repairs to wooden pallets, we have found, are nominal, since some of them may be used only three to four times a year, and some less. All pallets should be the four-way type.

Our elevators have a capacity of 6000 pounds, with 10 percent overload, which makes it possible for them to handle three pallet loads and equipment, either the dolly or the stacker. It is possible to increase the capacity of elevators by installing cables, drum, gears, and bigger motor; all of which however is strictly an engineering problem.

The gap between the elevator and room entrance may be taken care of with special sills made for that purpose. The better ones are somewhat costly, but they serve a very good purpose and are worth the investment.

Advantages of Palletizing

The advantages of palletizing, in our experience, has resulted in labor saving, speedier and more efficient handling of products, which is to the advantage of the warehouse, as well as to the customers. It also provides a better storage carry of products, eliminates possible heat pockets on commodities received partially thawed. For cooler products it provides better circulation and eliminates dunnage.

Mechanical handling helps to avoid accidents and injuries, resulting in decreased outlay for compensation, damaged goods, lost time, unproductive and uneconomical use of human energy; avoidance of excess man power, and delays, thereby providing a big factor in improved customer relations; larger and heavier loads may be handled with a fraction of the personnel required for hand stacking.

Loss of space resulting from palletizing will run from 10 to 25 percent, depending upon the layout. Labor savings amounts to about one-third to one-half.

One of the things to watch carefully is the overloading of elevators, especially during rush hours when the men are in a hurry. The elevator operator should be charged with the responsibility of watching this carefully. A breakdown resulting from overloaded elevator may be very costly in both money and time.

Correction in NH_3 Article

WE ENJOYED very much reading Ken M. Holaday's article entitled "How Dangerous is Ammonia" which appeared in the February, 1955, issue of INDUSTRIAL REFRIGERATION. We certainly agree that one of the chief hazards in the use of ammonia is its toxicity.

"For the record, however, we would like to point out an error in Table I of the article. Table I is entitled "Toxicity of Common Refrigerants". Data are given for the duration of exposure and lethal concentration for various common refrigerants. The figures which you have quoted for "Freon-22" monochlorodifluoromethane, we believe apply to "Freon-21" dichloromonofluoromethane. Guinea pigs exposed to concentrations of about 20 percent by volume of "Freon-22" in air for two hours recovered without any observable ill effects."

—R. C. DOWNING, Technical Assistant, "Kinetic" Chemicals Division.

Editor's Note: Mr. Downing's correspondence is much appreciated. However, the error is not Mr. Holaday's, but that of the Editors. Mr. Holaday's article appeared in the 1954 edition of the NAPRE *Operating Data Book* and the listing in Table I, to which he refers was correctly listed as "Freon-21". The misquote of "Freon-22" appeared when we published Mr. Holaday's paper in the February issue of INDUSTRIAL REFRIGERATION.

Air Conditioning Improves Temperatures For Metal Parts Plant

Interior view of Dornson Metal Parts Plant where air conditioning stabilized temperatures and improved working conditions.

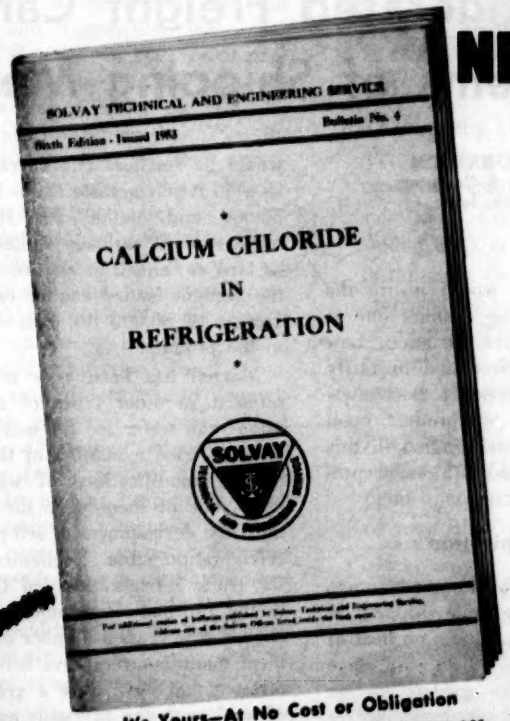
IN THE Dornson Corporation plant, a metal parts manufacturing firm located in Los Angeles, stable temperatures were especially needed for the operation of the firm's Pratt & Whitney 1-E Jig Borer, which operates at 00 tolerances under 68 — 70 F temperatures. The expansion and contraction of metal parts, aluminum parts in particular, were vitally affecting close tolerances. Variations of .0008 were noted over a 15 degree temperature range.

It was decided to air condition the Dornson plant in order to maintain the stable temperatures necessary to precise machining. It is interesting to note that, although the building is located less than three miles from the Pacific Ocean and therefore is in the California coastline's "cool zone", air conditioning was nevertheless required to maintain the proper temperature conditions.

Metal Expansion Eliminated

With the installation of air conditioning, the problems of metal expansion and contraction were eliminated. The equipment, a Typhoon Model 214 SC 20 ton packaged air conditioning unit, serves as a ducted central station system, with grilles located at critical spots throughout the plant. It was installed by the D. L. Kissell Co. of Los Angeles.

The office area of Dornson's is also air conditioned by this Typhoon unit. A motorized thermostat-controlled damper is situated in the ductwork to control the distribution of cool air to the office area, as the lower temperatures required in the plant are not necessary for office comfort. Harry Dobson, owner and manager, reports that, in addition to the elimination of mechanical problems, his employees are pleased at the comfortable conditions they work in, and morale and efficiency are improved.



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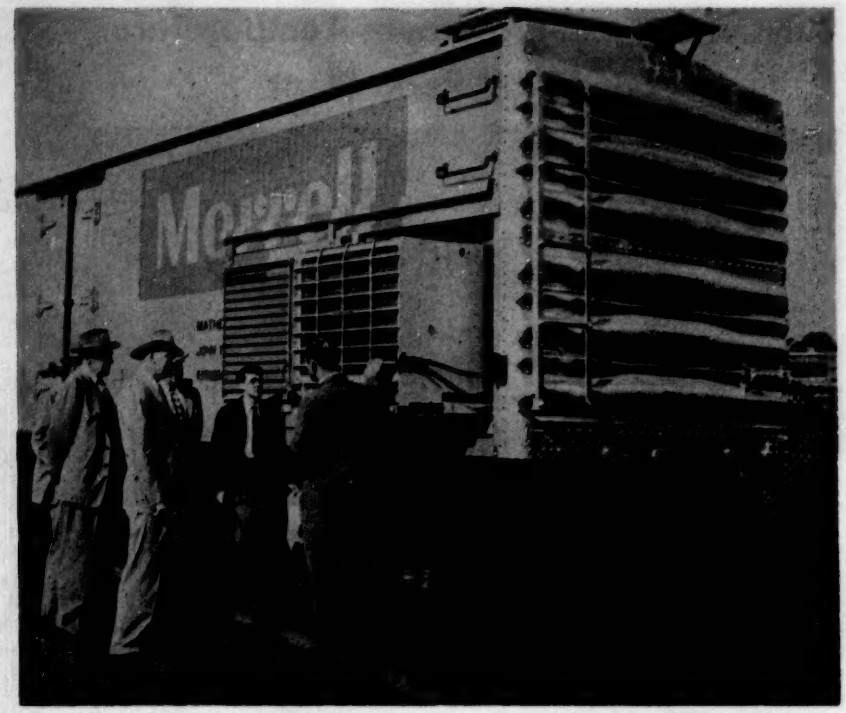


Morrell Officials inspect first of a series of new refrigerator cars equipped with Thermo King mechanical refrigeration units.

Meat Packer Reports

Says Mechanically Refrigerated Freight Cars Offer Answer to Problems of Shipping Meats

RALPH W. RANSOM
John Morrell & Company,
Ottumwa, Iowa

THE transportation of meat and meat products is peculiar from many other refrigerated products in a number of respects. In the first place, considerably more than 50 percent of it is transported in what we call mixed cars. Any combination of products are packed together, and frequently have to be mixed in order that truck loads for customer delivery will come out of the car as a unit. This means that products that should be kept in the low thirties often-times have to be loaded immediately in contact with product that is normally chilled only to 60 F, or even next to items such as shelf goods from the canned meat department.

It sounds logical to pre-chill everything to a temperature near that of the lowest product; but, regardless of efforts in that direction, we have never been able to accomplish this to a degree that would insure the absence of shipping troubles due to product temperature variation. Low temperature air circulated in fairly large volume is necessary to counteract the effect of one product upon the other when intermingled in this manner. Mechanical equipment provides the answer.

Paper read at meeting of Chicago Chapter, American Society Refrigerating Engineers.

No Heat of Respiration

We are blessed with one advantage over fruit and vegetable shippers in that our product produces no heat of respiration. While we do ship some frozen products, the greatest portion of shipments are at temperatures ranging from the low thirties to the high forties. Were we able to load like products or like temperature products in carload lots our problem would be smaller. The average load in a 40 ft refrigerator car is between 30,000 and 35,000 lbs. However, when straight carloads of items such as lard or canned meats are shipped, the amount loaded can be easily increased to 50,000 lbs with no harm to the product.

Morrell has been very much interested in other types of refrigeration than water ice for many years and has tried a number of them, including modifications of water ice use. None of them were the answer until the development of self-powered refrigeration units. Mechanical units for truck refrigeration led the way to the railroad development. Within the last few years a number of equipment manufacturers have become interested and have done a great deal of work with the railroads and shippers.

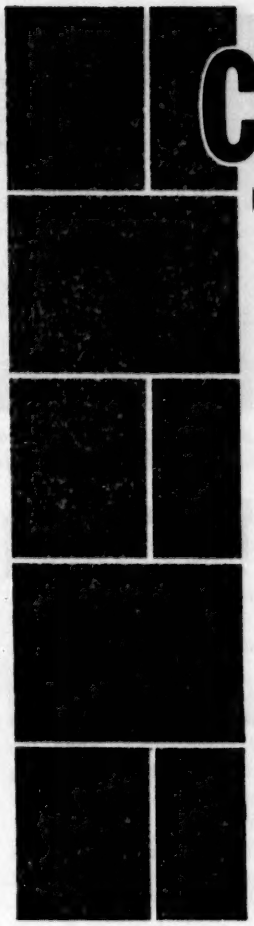
Without question, the use of mechanical refrigeration in rail transport is going to grow by leaps and

bounds in the next few years. Only a short while ago the predominance of opinion could only justify mechanical refrigeration in the transportation of frozen products. That is certainly the job where it is most adapted and most economical at present and the need for a large number of cars for this purpose will probably be the prime force in the expansion of fleets. Not only is the frozen food field requiring much better refrigeration in transport of the present tonnage, but the amount to be transported is growing rapidly.

In addition to this, actual shipments of fresh fruits and vegetables have taken an important position in test work and in test shipments. Apparently the only cars in use regularly, on other than frozen products, are eleven cars used in the New England States for transporting packaged milk to the Boston area (these cars being used as warehouses for direct loading into trucks at the delivery end), and the twenty-five cars we are using on meat and meat food products from our Sioux Falls plant to the Florida area.

All of the mechanically refrigerated cars now in use are railroad or subsidiary owned, except for the eleven and twenty-five just mentioned. Because of the mechanical equipment in the cars, the railroads assess a charge under the National Perishable Protective Tariff No. 16, Rule 170, covering test and experimental shipments. This charge amounts to approximately 17 dollars per carload shipped from Sioux Falls to Florida points. Efforts are being made to eliminate, or materially reduce, this charge. The question is being considered by the National Perishable Protective Tariff Committee, with proposals and counter-proposals presumed to cover the best method of handling. It would seem that the fairest method of handling would be for the carriers to check temperatures in mechanically refrigerated cars while enroute. For this they would make a nominal charge against the shipper. In addition, there would be a schedule for charges to be made for the repair and adjustment of equipment.

These things take a long time to work out, but Morrell has confidence it will be done to everyone's satisfaction. Already the railroads are taking definite steps to instruct and train



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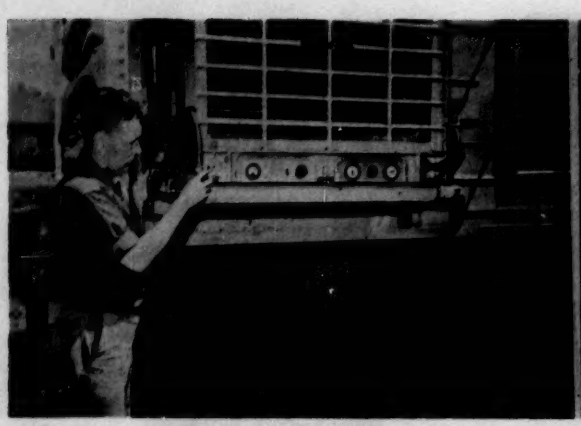

Thermo King engineer connects fuel line to mechanical unit installed in refrigerator car.

A variety of products is loaded at Sioux Falls, South Dakota for shipment to Miami, Florida.

repair crews who can take care of this refrigeration equipment at any point on their systems.

Shipping Rules for Meat

It would be well to point out here that meat and meat by-products are shipped under different rules than other refrigerated products. Packers may own refrigerator cars and mileage payments are made by the car owner to the railroad. The only refrigeration charges made in the past with iced cars have been a published charge per ton for ice and salt used at re-icing stations. As far as the refrigeration goes, the railroad's responsibility is to re-ice as instructed, assuming a normal transportation schedule.

Fruits and vegetables are subject to a published refrigeration charge, which puts the entire responsibility on the carrier for maintaining temperature and for satisfactorily delivering the product. The American Association of Railroads, early in the development, approved for free interchange the use of diesel powered refrigeration equipment. This means that a refrigerator car equipped with a diesel engine can be accepted by any railroad, and can move freely throughout the country. Quite recently the A.A.R. issued a memorandum to the effect that railroads can accept gasoline engine driven equipment for free interchange, if they so choose.

Shipping Frozen Foods

In the transportation of frozen foods, the product is usually in packages which fill the lading space solidly. The product is necessarily down to the desired storage temperature before being loaded. Thus, the theory of car refrigeration has been to envelope the product in a layer of the refrigerated air by providing side-wall ducts, with the air supply either delivered under the floor racks or in the chamber area over the product or in a plenum chamber in the ceiling. Thus the refrigerated air will absorb any btu's coming from the outside before they reach the product.

Most of the frozen product cars do not have a solid wall flue but permanent racks on the wall to provide about a one-inch space for air travel. The air supply delivered over the product seems to be giving place to a plenum chamber in the roof, which is usually four inches or more deep. Provision is made in the ceiling so air can be admitted to the space over the product if desired. The return air then travels back to the refrigeration unit under the floor racks, in a space approximately four inches high. One manufacturer reverses the air flow, delivering it under the floor racks, allowing it to come up the side walls and return to the refrigeration unit in the space over the product, not using a plenum chamber.

Use of Cold Air Envelope for Meats

The use of this envelope of cold air for the majority of meat shipments is questionable. Since we have products of all kinds, with considerable variation of temperature between adjacent boxes, we do not feel the sidewall flues are essential. All Morrell cars are equipped to deliver the cold air supply under the floor racks. The first three cars made have sidewall ducts, due to an opinion we might be using them for frozen product, but by the time the balance were under construction this possibility was pretty well eliminated and no ducts were provided.

Air Cools Products

The idea of permitting air to filter up through the product, wherever it can find an opening, so it will cool the warmer products during transportation and help avoid the heating up of the adjacent product is preferred by Morrell. The air return is in the space above the product. We provide a flue at the far end of the car from the equipment to allow good circulation of air should the load be such that little filters up through it. So far, this works very satisfactorily, with no indication of mistreatment of product.

One advantage sought by equipment manufacturers is to circulate the air in controlled passages to avoid moisture pick-up and thus cut down on requirements for defrosting of the low side coil during transit. This is undoubtedly a worthy effort in connection with transportation of frozen foods, but the advantages of filtering air around the packages outweigh frost accumulation disadvantages in our operations. It is not known here how this question is approached in connection with the shipment of fresh fruits and vegetables, where there is a decided heat load generated by the product itself.

Since we have been shipping all

packaged products thus far in these mechanically refrigerated cars we have not had to pay too much attention to the relative humidity. In actual operation we have maintained a temperature differential of air on and off the coil of between 15 and 20 degrees. When these cars are put into service on the transportation of straight carloads of beef and the product is uncovered we will undoubtedly find it essential to cut this temperature differential down to avoid excessive shrinkage.

Insulation

Up to the advent of mechanical equipment for car refrigeration, the construction of cars had gone through a continued process of evolution. Improvements in their construction were both due to better engineering, and the use of better and more materials.

It was not many years ago that two inches, with a maximum of three inches was considered adequate insulation for an ice refrigerated car. Efforts were made to provide vapor barriers but they were mostly in the form of paper. We know that the vibration and shock from car movement soon caused breakdowns in these materials.

For the last twenty years, the thickness of insulation has been gradually increased, by the meat industry particularly, and, while four inches of insulation was considered adequate by many, there were cars built in the late 30's with as much as six inches and with more care and better materials used.

Steel frame cars gave a great boost to refrigerator car construction, as they maintain a rigid body that does not permit racking and the resultant damage to the insulation and the vapor barrier. Steel outside sheeting for the newer cars, along with steel roofs, adds greatly to our ability to provide a good vapor barrier. More attention paid to the waterproofing of floors has aided greatly in maintaining the value of the insulation.

Most of the cars that have been built for mechanical refrigeration have gone into the frozen foods industry, where great attention has to be paid to these features. All of these are being built with a minimum of six inches of insulation in the walls and more in the floor and roof. Improved freight car truck design has cut down on the physical abuse the cars have to take. This is not only of benefit to the car structure and insulation, but also to the lading.

Development of Larger Car

Forty foot refrigerator cars have been pretty much a standard for many years, although some even as short as 36 ft are in use. With limitations of ice refrigeration there has been little effort to increase the size of the car. The advent of mechanical refrigeration has made this a very feasible move, particularly for the frozen foods, and the fresh vegetable and fruit people.

The refrigeration charges covered by the National Perishable Protective Tariff are based on unit carloads, without reference to the tonnage. Frozen foods can be loaded into 40 ft cars, up to about 80,000 lbs, and 50 ft cars up to 120,000 lbs, which readily explains one of the advantages of the larger car. The meat in-

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dustry cannot change as quickly and may not want to for years, due to the construction problems involved in the plants to accommodate car spots at enclosed docks to 50 ft car lengths. In addition, the larger tonnages in carload units are not desired.

The space in a 40 ft car is about 1,800 cu. ft. and that of a 50 ft car 3,000 cu. ft. Mechanical equipment has been installed in 50 ft cars to provide a circulation of about 4,000 cu. ft. per minute. Probably more installations are made to circulate between 2,000 and 3,000 cu. ft. per minute. Our cars are designed for the circulation of 2,250 cu. ft., or a complete change in less than 50 seconds. Actually, the space in the car is displaced about 50 percent by the product load, which means an air change about every 25 seconds.

Motive Power

All the equipment being manufactured by Frigidaire, Trane, and Carrier is diesel engine driven. The diesel drives a generator, which furnishes power for the compressor as well as all the rest of the equipment. The generator is rated at 15 to 25 kw, 220 volt, 60 cycle, 3-phase. The Thermo-King equipment is gas driven, with the engine direct connected to the compressor and a small generator to operate fans and recharge a storage battery. Carrier Corp. is reported contemplating equipment of a similar nature.

Morrell's Thermo-King units are self-contained. Both high and low side mounted on one base, quickly clamped into place, and requiring only a gas and battery connection. Others are mounted in cars in two to four parts. A four-part installation is mounted with the engine-generator one unit, the motor-compressor the second unit, the condenser-radiator-fan another unit, the evaporator fan the fourth unit.

Changes in this respect are constantly in the minds of the manufacturers of the equipment, particularly looking toward the complete unit on one base. The compressor displacements vary. Since most development has been for frozen shipments this is high when considering our needs. I believe about the maximum has been 60 c.f.m. About 30 c.f.m. is adequate for our needs with the car construction we are using.

Defrosting of the evaporator coil on the three diesel-electric units is done with electric heating elements. Drainage of the drip pan is assured by installation of a heating element there also. The units we have in operation are hot gas defrosted. One manufacturer has developed an extremely large evaporator coil, of sufficient surface to be defrosted at the end of a trip. This might work out satisfactorily for frozen food shipments but we doubt that it would do for products handled above freezing temperatures, or especially where some air circulation is required through the product load.

Space for Equipment

The space required at one end of the refrigerator car for the mechanical equipment is very near the same for all the present makes of equipment, or about six feet long by the width of the car. This space will accommodate two of the Thermo-King complete units. The capacity of the unit and the construction of the car are such that only one need be used for our operation. Frigidaire is experimenting with an installation in which the high side is mounted under the car at about the center and the low side mounted in the ceiling above it. This has an advantage of saving some space for lading, but a disadvantage in placing the high side equipment in a serious weather and dirt position.

Our 25 cars are leased from the Mather Stock Car Co. and are returned directly to our plant at Sioux Falls. Mather receives a mileage payment from the railroads for all miles traveled, whether loaded or empty.

Service Contract

Morrell entered into an agreement in January 1952 with the Thermo-King Railway Corp., whereby they were to provide refrigeration equipment complete. The lease agreement required them to provide temperature in these 25 cars as demanded by us and we to pay for it on an hourly basis. Thermo-King is maintaining the equipment, including gas, oil, maintenance, replacement, etc.; our only responsibility being to keep them advised of the movement of cars. For this purpose Thermo-King have a man on duty full time at Sioux Falls with facilities for the servicing of the refrigeration equipment.

There have been a few minor changes in the contract since it was originally signed. The present agreement calls for a payment on our part to Thermo-King of 60 cents an hour for the first 2,000 hrs./yr. that the refrigeration equipment is in use, and 32 cents for all over 2,000 hours. The time is based on a recording clock attached to the mechanism, which operates all the time we have the switch turned on, whether the equipment is required to run to maintain temperature or not.

Thus on a 5-day delivery, or 120 hours we would pay Thermo-King 72 dollars for refrigeration at the higher rate. Each car makes 17 or more trips per year, so we do get into the lower rate for a few hours. The Thermo-King Railway Corp. is absorbing the 17 dollar charge now made by the railroads under Perishable Protective Tariff rule. Thermo-King entered into a contract with the Mather Stock Car Co. in order to cover the details of installation of their equipment in the cars we lease from Mather.

Any time the refrigeration unit is run at the Sioux Falls plant for servicing, adjusting, etc. is not charged to John Morrell & Co. Our practice in warmer weather is to start the unit in the early morning, run it for an hour and a half before loading operations. It is shut off during loading as the employees object to the temperature and draft or ask for freezer pay scale. If the loading is not completed by noon the car is closed during lunch period and the unit operated.

When the car is closed and sealed the switch is turned on and left until it is opened for unloading. Our instructions are that if the car temperature is satisfactory and the unit fails within one and a half to two days of destination it should be hurried on through, with no effort to repair the unit or provide refrigeration in another manner.

As soon as the car leaves Sioux Falls a wire is sent to Thermo-King, who have agreements with the railroads for the reading of temperatures and the wiring of them to their home office in Minneapolis. These readings are taken at regular icing stations. This gives Thermo-King the information needed to know when something

is wrong with the refrigeration equipment and to call on one of their truck refrigeration service agencies along the route to investigate and take whatever action is needed. They have two or three refrigeration units at strategic points which can be installed in place of a unit that fails.

Information Collected

Morrell's actual experience is not great enough to date that we can do much more than give a brief summary of the results, and state that we are continuing to accumulate as detailed information as possible on each carload shipped so that our future expansion of the fleet can be intelligently judged. In addition to the 25 mechanical cars, we are shipping quite a number of iced refrigerator carloads. By keeping account of all the information on these shipments, we are getting a direct comparison between mechanical refrigeration and ice.

The information includes a fairly detailed breakdown of the product loaded into the cars, with temperatures. We are accumulating data on both off-condition product claims and complaints, as well as damage claims. On the mechanical cars, we obtain a recording thermometer chart of the temperature just above the load at the center of the car, in addition to temperatures read by railroad personnel enroute, and all the data on maintenance, repair, gas, oil, etc. Thermo-King are cooperating in furnishing detail costs.

One mechanical car has been in service since May 1952, three more since December 1952, and the balance went into full service during May of 1953. From the end of March, 1953, to October Morrell shipped 155 carloads of product to Florida in mechanically equipped cars. There were claims for spoilage of product in seven of these cars, only two of them in which temperature conditions indicated spoilage occurred in transit.

Average Claims are Low

One of these could hardly be called spoilage as the thermostat failed to operate and the refrigeration unit kept running, so a great deal of the product was frozen on arrival. The second of these was a very serious personnel failure. For some reason or other, the report of temperatures enroute failed to get through or were not heeded. The unit did not operate and when the car was opened in Florida it was found to be at 60 F. The claim on this car was $683.13. All the rest of the claims on the other six cars amounted to $60.21.

Excluding the one car with the very heavy claim, the average claims for spoilage on iced cars during this same period was 93 cents per car, against the average of 39 cents for mechanically refrigerated cars. Actually, this is an insignificant amount.

No attempt will be made here to go into any discussion of the acceptability of the product at the Florida end, except to state that there is an outstanding difference; a great improvement. Our customers and our salesmen are most enthusiastic.

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(Continued on page 56)

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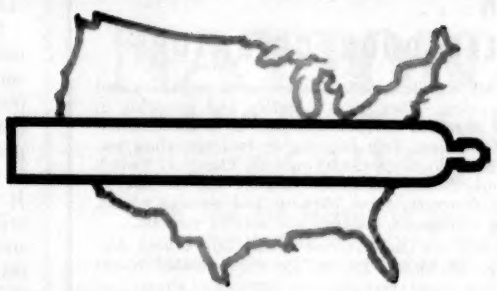

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Southwestern Sales Meet Reviews Plans For Selling More Ice

THE Spring Ice Sales Meeting for Managers and Supervisors, sponsored by the Southwestern Ice Manufacturers' Association, was held in Waco, Texas, April 20 and 21, 1955 at the Roosevelt Hotel.

Opening the meeting, Frank B. Alderdice, Southland Corp., Dallas, Chairman of the Merchandising Committee pointed out the need for more active promotion of the sale of ice itself, in whatever form may be required by the consuming public.

As guests of the Southland Ice Company, Waco, visitors were taken in small groups through the entire operation. The results of Southland's aggressive modernization and merchandising activities were apparent on every side.

At the Wednesday evening session, C. D. (Doug) Parsley, manager of the Southland Corporation's plants in Austin, gave an interesting discussion of "party ice". Mr. Parsley had arranged three ice carvings specially prepared for the occasion, consisting of figures of a steer, a star, and a boot. Discussions which followed covered methods of sales promotion for party ice, the services neded to promote such sales, prices charged and profits to be gained from this market.

O. T. Clark, Jr, Fort Worth, reported that for the past five years they have tried to get ice to the consumer in paper bags, placing them as cheaply as possible as far as their investment is concerned. They have placed ice cream cabinets in which ice is kept packaged in plastic bags, in small stores and markets. in El Paso, they have also used vending machines. It has been a problem to find sufficient outlets to sell enough crushed ice without spending too much money. This year they plan to go into putting ice into the larger super-markets, in Fort Worth.

Walter A. Lankford, merchandising manager for U-Tote'M, Inc., Houston, Texas, discussed the promotion of sales of convenience and luxury ice through drive-in grocery stores. In the discussions which followed Mr. Lankford's talk, it was brought out that the industry needs to get a container for cracked, or sized ice, that will fit the needs of two, three, or four people. In one locality, the practice was discovered of selling 5 and 6-lb sacks of cracked ice in small grocery sacks at 15 cents per sack, and considerably more was sold in that sized bag than in the larger size.

A discussion of the cross-road store outlets for recapture of rural business was led by J. B. Hayes, Jr., of the Southwest Ice Company, Marshall, Texas. Mr. Hayes developed and is having manufactured a large size storage chest suitable for heavy duty outside storage. He said that this development grew out of their continuing losses of business in the country areas. They now have out 38 boxes, and are going to put out more this season. With this method of merchandising they expect to pick up more tonnage.

At the close of the general discussions, Chairman Alderdice asked for suggestions on listing of outlets on today's ice market that afford opportunities for practical and profitable development of the ice business.

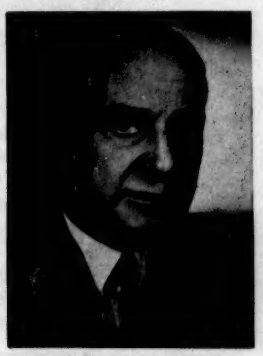
A number of suggestions were offered, the two on which it was thought special emphasis should be made, being listed as follows:

1. Moving ice up front and development of merchandising boxes.

2. Development of rural market and playground market.

City Products Elects Sinek Chairman of Board

AT THE Annual Meeting of City Products Corporation held April 21, at the corporation's office in Cleveland, Ohio, the stockholders voted favorably on the amendment to the Code of Regulations creating the office of Chairman of the Board. William J. Sinek was elected both Chairman of the Board and President for the ensuing year. The Chairman of the Board becomes the chief executive officer of the corporation. Mr. Sinek stated that the year 1954 was another year of expansion and progress for the corporation. The corporation maintains its unbroken record of yearly dividend payments extending back to the year 1894 completing 61 years of continuous dividend payments. The first quarter dividend for 1955 has already been paid as of March 31, 1955.



Wm. J. Sinek

He reported the corporation's net sales for 1954 amounted to $80,764,161 as compared with $84,315,677 for 1953. Net profits for 1954 were $3,538,445 equal to $2.82 per common share. Decline in sales was caused in part by the sale early in 1954 of a sheet metal jobbing plant which normally had a sales volume exceeding $2,000,000 annually. During 1954, the corporation expended approximately $3,500,000, most of which was for requirements in connection with the corporation's long term railroad car icing contracts, the purchase of a number of ice properties in Florida and Arizona, construction of a large ice manufacturing plant in Kansas, and construction of vegetable cooling plants in Texas and Arizona.

Property and equipment of the corporation were maintained in excellent condition. Maintenance and repair in 1954 amounted to $3,800,000.

Mr. Sinek stated the corporation has an excellent management team and a strong supporting organization in engineering, production and sales, with increased sales and improved earnings as their goal for all divisions in 1955.

During the year the corporation increased its investment in oil and gas holdings in Oklahoma, Kansas and Texas which now include interests in 36 producing oil and gas wells.

All directors were re-elected. They are as follows: William J. Sinek, chairman of the board and president; George E. Allen, Washington, D. C.; William J. Froelich, Chicago; Edward O. Boshell, Pittsburgh, Pa.; Lloyd L. McCoy, St. Louis, Mo.; Andrew R. Carlson, Chicago; Richard C. Muckerman, St. Louis, Mo.; Henry Crown, Chicago; Eugene F. Rosfelder, Chicago; William F. Zeidler, Chicago.

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Vapor Barrier
Requirements For Cold Storage Structures

S. J. STACHELEK, ENGINEER
Owens-Corning Fiberglas Corp.
Toledo, Ohio.

WATER vapor resistance values in cold storage construction have been recognized for a generation. However, it has only been in the present decade that any emphasis has been given to placement of a specific amount of vapor resistance. Carl Munter's paper entitled, "Moisture in Walls of Cold Storage Rooms"[1] helped awaken the industry to the *Why* of vapor barriers. This presentation is aimed at explaining the *When, Where* and *What* of these critical elements of cold storage construction.

The warm-side vapor barrier rule so effectively analyzed and sold by Tyler Stewart Rogers, in his "Design of Insulated Buildings for Various Climates"[2], found an appreciative ear in the cold storage industry. Designers of sharp and storage freezers today accept the single vapor barrier as a tested and true approach. Qualms came when designers searched for rules regarding use of vapor barriers when conditions of reversible-flow of water vapor were encountered, as in cooler and chiller room designs for northerly climates. Although design engineers must approach this problem in a technological manner, several practical answers are readily derived.

Outdoor Vapor Pressures

To the engineer, the lowest common denominator of water vapor measurement is its pressure. By associating vapor pressures with dew point temperatures, we need further only a reference to a dew point conversion chart (such as the nomograph, Fig. 1) to study vapor barrier requirements more fully.

With this implement in mind, visualize insulation's ever present foe — outdoor water-vapor pressure. Figs. 2, 3 and 4 portray such pictures for representative areas of the country as Chicago, Kansas City and New Orleans. Note that vapor pressures are measured in inches of mercury pressure. Although this data is taken from Dr. Paul A. Siple's "Climatological Interpretations"[3], it is based on U.S. Weather Bureau data compiled for half a century, and represents average annual conditions. For reasons of brevity, but one of these areas will be analyzed and, because reversible vapor pressure conditions are more problematic in colder climates, conditions represented by the Chicago area are chosen.

Basically, refrigerating engineers have two reasons for being interested in vapor control. The first is the important economy of reducing heat gain or loss in construction due to gain or loss of vapor-borne latent heat. The second is the dollar-consuming cost of decreased insulating efficiency of structures when moisture affects the sensible heat insulating properties of materials. Proper utilization of vapor barriers, therefore, calls for keeping these two objectives firmly in mind, sacrificing as little of each as theory and practicality may require.

Unilateral Pressure Range

Refer to the outdoor vapor pressure diagram for the Chicago area. Should the lowest average pressure throughout the year be equivalent to about 0.118 inches of mercury, (the lowest outdoor reading) any cold storage room operating below that pressure (a dew point of 23 F) should have a one-sided pressure differential; that is, vapor travel is from one direction. This implies, of course, that such rooms should be constructed with a single vapor barrier, located as close as is feasible to the higher pressure (outdoor) side. It also suggests that interior surfaces of such rooms should be as vapor porous as is feasible, to keep a constant desiccant action working on the insulation to maintain it moisture-free and operating at peak efficiency.

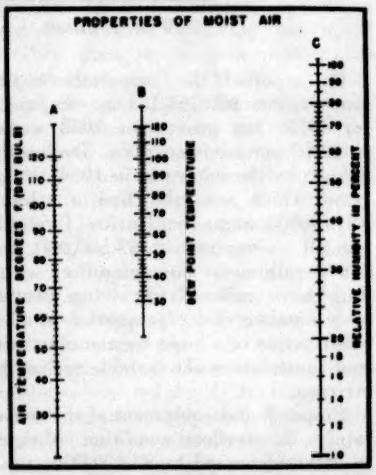

Fig. 1—To determine Dew Point temperature of any room place a straight edge on applicable figures of its air temperature (A) and Relative Humidity (C), then read the answer on scale B.

Although there are still several important questions to answer, such as required vapor resistance of the single vapor barrier, the minimum permeability of the porous surface, and considerations of climatic extremes rather than average conditions, approach these after analyzing associated conditions in other than the unilateral range.

Paper contributed for recent NAPRE Midwest Educational Conference, was previously given before the AMI-ASRE joint engineering committee, Chicago, January, 1955. by Mr. Stachelek.

[1]Paper delivered at 36th meeting, ASRE, June 1949.

[2]Published by F. W. Dodge, 1951.

[3]Bulletin, AIA, Sept. 1950.

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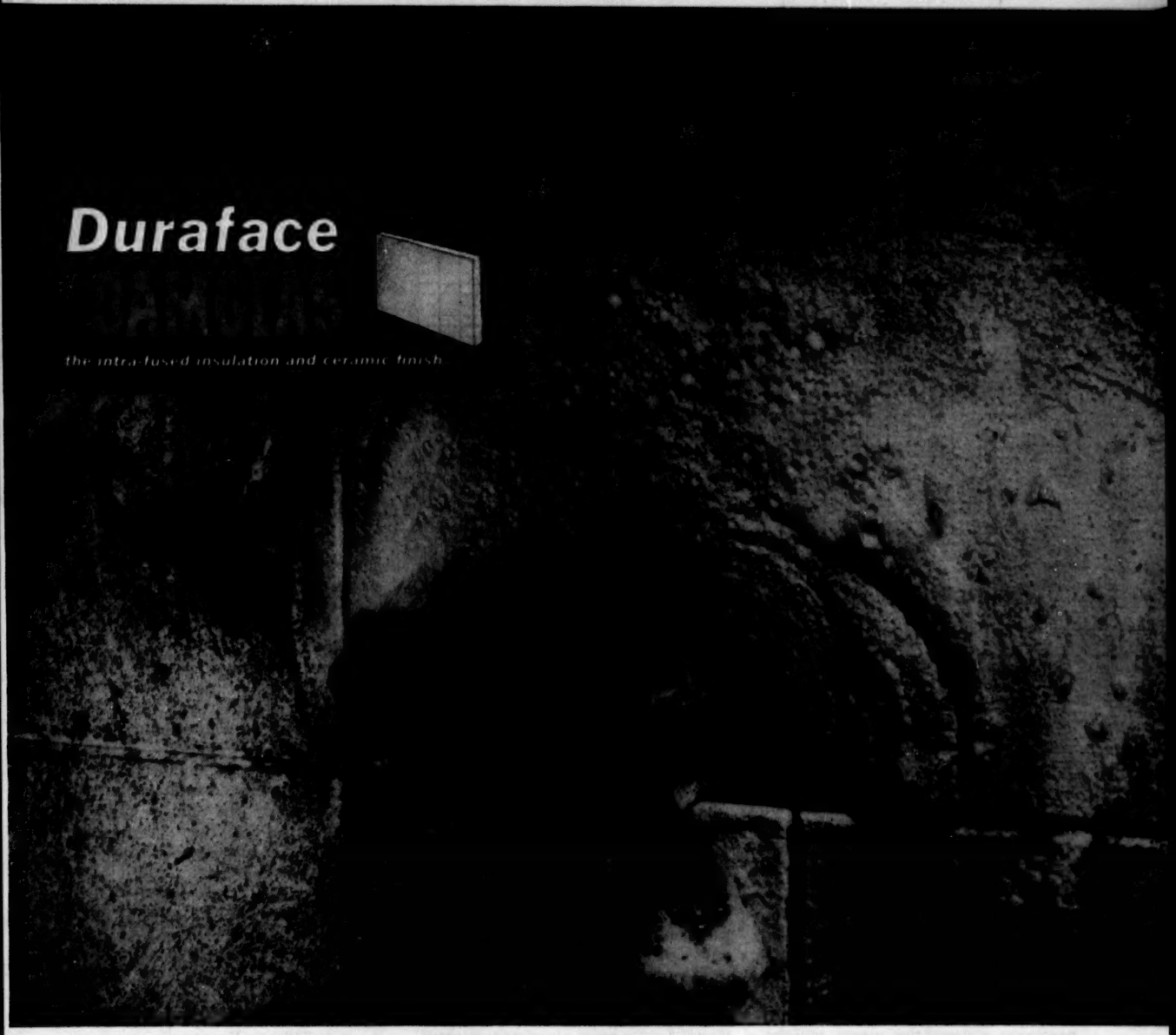

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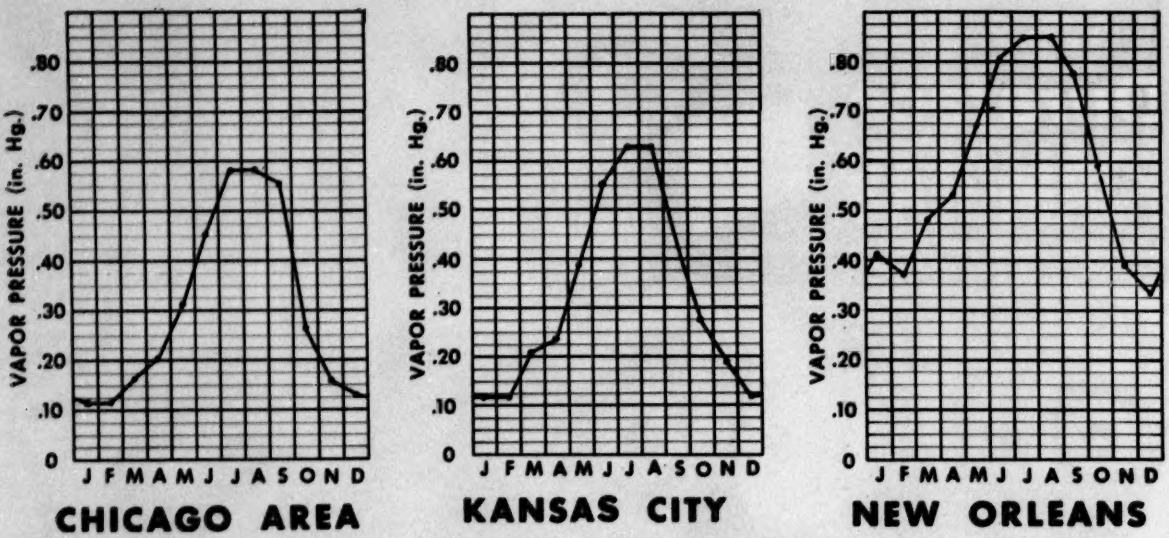


Figs. 2, 3, 4—Average outdoor vapor pressure conditions for three representative areas of the country.

Reversible Pressure Range

Again referring to the Chicago Area vapor pressure chart (Fig. 2), note that the pressure range from 0.118 (dew point, 23 F) in January and February, to 0.582 (dew point 63 F) in midsummer, presents an entirely different picture. By drawing a horizontal line (Fig. 5) within this range (which would represent interior room conditions of vapor pressure as constant throughout the year), notice that vapor pressures on such a room wall will no longer be one-sided. During the winter months vapor pressures are greater within the room, reversing to less-than-outdoor pressures during the warm months of the year.

Note also, depending upon the operating dew point of the room, that these pressures can vary in their percentage of operating time between positive or negative pressures. The most critical condition, of course, would be a room operating at the pressure equalization line of this vapor pressure curve (See Fig. 5). For the Chicago area this would be an operating dew point of about 47°F, as represented by a 50-degree room at 90 percent relative humidity. This room would have approximately as much negative pressure-time units as positive ones.

The usage to date pointed to but one solution: seal the insulation as thoroughly as possible from both sides and hope for the best. The introduction of non-permeable insulation and asphalt-enclosed products was a boon to this practice and resulted in many installations that have been given satisfactory service. Enough unexplained failures have occurred, however, to create a demand for a more scientific approach and a solution to this troublesome problem.

Balanced Permeability

A very practical solution is evident, after a brief analysis. It permits use of vapor-porous insulations which are generally, substantially lower in cost and better in thermal conductivity. It, also, alleviates problems caused by failures of mastic joints and expansion-contraction spalling of insulation and finishes.

The analytical approach proposed is to determine the vapor resistance required on either side of the insulation, to prevent moisture entry greater in amount than that which would cause more than a negligible effect on the insulating properties of the material used.

This "permissible" amount of moisture entry will vary somewhat with materials as different cellular and fibrous structures are not affected to the same degree by the same amount of distributed moisture. Organic products, of course, may be limited largely by moisture percentages which would start accelerated decay action. Products analyzed by the writer were fibrous glass boards of 4¼ to 6-lb density, whose thermal conductivity showed no appreciable change with moisture contents somewhat greater than the 10 percent by weight.

To use the more conservative example, the 4¼-lb board applied in a 3-in. thickness weighs 1.06 lb/sq. ft. With 10 percent by weight permissible moisture entry, 1.7 ounces or 742 grains of moisture is the maximum design criterion. Moisture vapor entry per square foot will be equal to the permeance of the surface considered, multiplied by the acting vapor pressure and time under such a condition.

From the pressure equalization line (which represents maximum reversible conditions), the Chicago climatic conditions call for the following interior surface permeance during the cold weather seasons:

$$\text{Vapor Entry} = \text{Permeance} \times \text{Pressure} \times \text{Hours}$$

$$742 = \text{Permeance} \times (.324 - .118) \times (720 \times 4\tfrac{1}{2} \text{ months})$$

$$742 = \text{Permeance} \times .206 \times 3240$$

$$\text{Permeance} = \frac{742}{.206 \times 3240}$$

$$= \frac{742}{668} = 1.11 \text{ Perms}$$

(Note: Pressure and time units above must be averaged out to reflect a true pressure-hour relationship. The most accurate method to do this is to determine the "moment of inertia" or centroid of pressure, and multiply by total hours. For simplicity, the maximum pressure multiplied by an average of the more discernible time factor is used in this example. A greater thickness of insulation too, would permit a larger intake of moisture.)

The calculated Permeance of approximately 1 Perm (1 grain of moisture/hour/square foot; inch of mercury pressure difference) indicates that, with such an interior surface rating, an excess of moisture will not enter the insulation. The small amount that does readily "dries out" to the room, when the pressure cycle again reverses during the warm sea-

sons. This again can be calculated in the same manner. However, it is easily seen that the average temperature at mid-point of the insulation during summer periods will create vapor pressures substantially greater than that used in the equation above. With any three multipliers in our equation, greater, a larger amount of water vapor would be permeated thus assuring drying-out conditions.

The determination of 1 Perm as a required vapor barrier rating is somewhat of a fortunate coincidence. A commonly accepted finish on interior walls of cooler rooms is a washable construction composed of cement plaster with one or two coats of "refrigeration enamel" paint. This,

TABLE 1—VAPOR PERMEANCE OF BUILDING MATERIALS PERMEANCE VALUES IN GRAINS PER SQUARE FOOT PER HOUR PER INCH OF MERCURY PRESSURE

Material	Vapor Permeance
Exterior Materials	
Brick masonry, 4 in.	1.1
Concrete block, laid up	2.0
Concrete (1:2:4 mix) per inch	3.2
Paint film (varies with age)	3.4
Pine lap siding	4.9
Plywood, ¾ in. exterior grade, 3 coats outside white paint	0.17
Plywood, (plyscord) 5/16 in., no finish	2.13
Building Papers	
Waterproof paper, light weight slater's felt	49.1
Sheathing paper, asphalt impregnated, glossy	0.17-2.05
Roll roofing, smooth, 40-65#/108 sq. ft.	0.13-0.17
Sheathing	
Fir sheathing, ¾ inch	2.9
Insulating lath & sheathing, board type	25.7-34.3
Insulating sheathing, surface-coated	3.03-4.36
Plywood, ⅜ in., 5-ply Douglas fir	2.7
Interior Finishes	
Gypsum lath with aluminum foil backing	0.09-0.39
Gypsum wall board, plain, ⅜"	50.0
Plaster base and plaster, ¾"	14.7
Plaster, wood lath	11.0
Plaster, fiberboard or gypsum lath	19.7-20.6
Plaster, 3 coats of lead and oil	3.68-3.84
Plaster, smooth, with Enamel brushed on	0.5-1.5
Plaster, 2 coats of aluminum paint	1.15
Plywood, 2 coats asphalt paint	0.43
Plywood, 2 coats aluminum paint	1.29
Fiberboard, 1 surface asphalt coated	3.9-8.5
Wood, spruce or pine, ½ inch	1.7-2.0
Hard fiberboard	4.7-10
Tile wall, with mortar, 4 inches	0.12
Asphalt mastic, cut-back, ⅛"	0.41
Asphalt mastic, emulsified, ⅛"	1.13
Insulating Materials	
Mineral Wool, unprotected	29.07
Insulating cork blocks, 1 in.	6.19
Foil-surfaced reflective insulation, double-faced	0.08-0.13
Fibrous glass bonded boards	29.0-49.0
Fibrous glass, factory asphalt-enclosed	3.7-9.9
Cellular glass insulating block	0.000
Cellular plastic insulating block, 1"	1.0-2.4
Vapor Barrier Papers	
Duplex or laminated papers, 30-30-30	1.37-2.58
Duplex or laminated papers, 30-60-30	0.52-0.86
Duplex paper, coated with metallic oxides	0.52-1.29
Insulation backup paper, treated	0.86-3.42
Duplex sheet, asphalt laminae, with alum. foil	0.002-0.176
Kraft and asphalt laminae, 30-120-30	0.3-1.8
Asphalt saturated sheathing paper	3.3-20.2

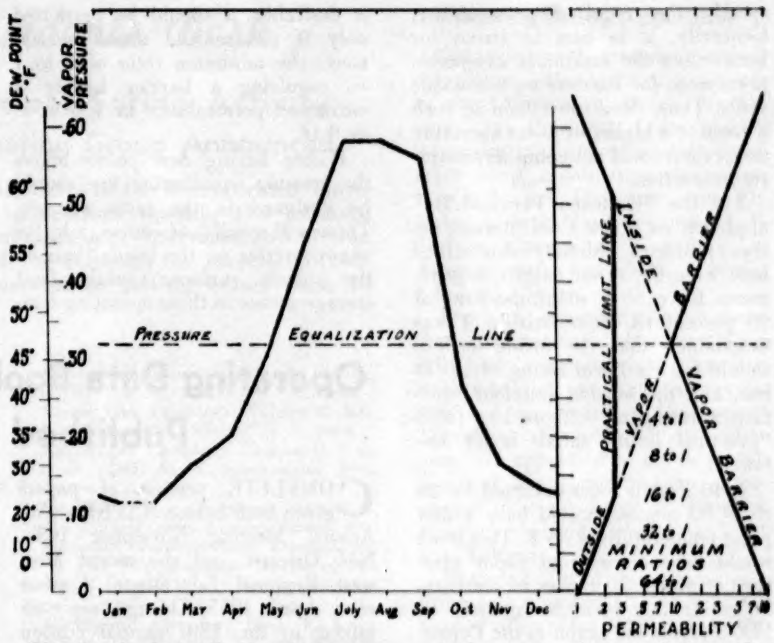


Fig. 5—Analysis of a vapor pressure curve for any region can help to determine required vapor barrier efficiencies for inner and outer wall surfaces of cold storage construction.

by reference to a table listing vapor barrier ratings of various materials (such as Table 1) has ratings in the range of what is desirable for Chicago-type climates.

A similar cooler room with equivalent dew point temperature, operating in the more southerly climates of Kansas City and New Orleans (Figs. 3 and 4), would require a proportionately less effective interior vapor barrier. If the same kind was used, a more effective exterior barrier would be needed.

Vapor Barrier Ratios

Although the "Permeability Balance" approach has this far been used for interior surfaces only, the same theory and similar calculations can be used to determine a permeability balance between inner and outer surfaces of the insulation. With the inner vapor barrier requirements calculated at the "pressure equalization line", data can readily be extended to empirical values derived from field studies, which confirm the theory and gives practical limits for designing vapor barriers.

Study the theoretical vapor barrier requirements for inner and outer wall surfaces as identified by the large X at the right of Fig. 5. Such theoretical data is based on average annual conditions which are seldom experienced. Because of this we must add safeguards to keep our structures operating safely even through "record breaking" heat waves and freezing periods. Such a safeguard is in common practice and inexpensive to integrate into our construction. By setting an arbitrary limit on vapor porosity of the warm or higher-vapor-pressure side (noted as "practical limit" in Fig. 5), we can give ourselves a safety-factor with little or no added cost.

The Vapor Barrier Ratios noted on Fig. 5 are, therefore, the minimum differentials between permeances of inner and outer barrier surfaces. It must also be understood that the ratio is the governing factor and that permeance of either surface can be adjusted to meet construction, use (such as washability) or permeance requirements due to reversible climatic conditions.

Designing With Vapor Barrier Ratios

To follow the design theory presented in Fig. 5, a ready reference to water vapor permeability of construction materials is a must. Table 1 meets this requirement, but periodic supplementation is necessary to keep abreast of new materials entering the market. In adding to this list, vigilance is necessary to keep track of variances in permeability of a product, and use of, or conversion to, the same unit of permeability. With a satisfactory list, a designer can easily choose the material to be used on either side of a wall, or

specify the required permeability. Generally, it is best to strive for better than the maximum acceptable permeance for barriers on warm-side walls. Thus, later conversion of such a room to a higher or lower operating temperature will not entail any major reconstruction.

Try the "Balanced Permeability" approach on a few Cold Storage design problems. Already determined here were the vapor barrier requirements for a 50 F room operating at 90 percent rh. Summarizing it was determined that the inside surface should have a Perm rating of 1.0 or less, and the outside (outdoor) surface a rating of 0.25 or less (with "practical limit" safety factor followed).

A 40 F chill room designed for an rh of 80 percent, would have a dew point temperature of 35 F. This room would have an internal vapor pressure of about .20 inches of mercury. Following that point horizontally on Fig. 5 across the graph to the Permeability chart, we read:

Inside Vapor Barrier = 2.5
Outside Vapor Barrier = 0.45 max.
or, with Safety Factor = 0.25
Minimum Ratio = 6 to 1

If in this case also, a plaster painted finish having 1 Perm rating is desirable, it should be permitted only if the outside vapor barrier meets the minimum ratio of 6 to 1 — requiring a barrier having a *maximum* permeability of 1/6 of 1, or 0.16.

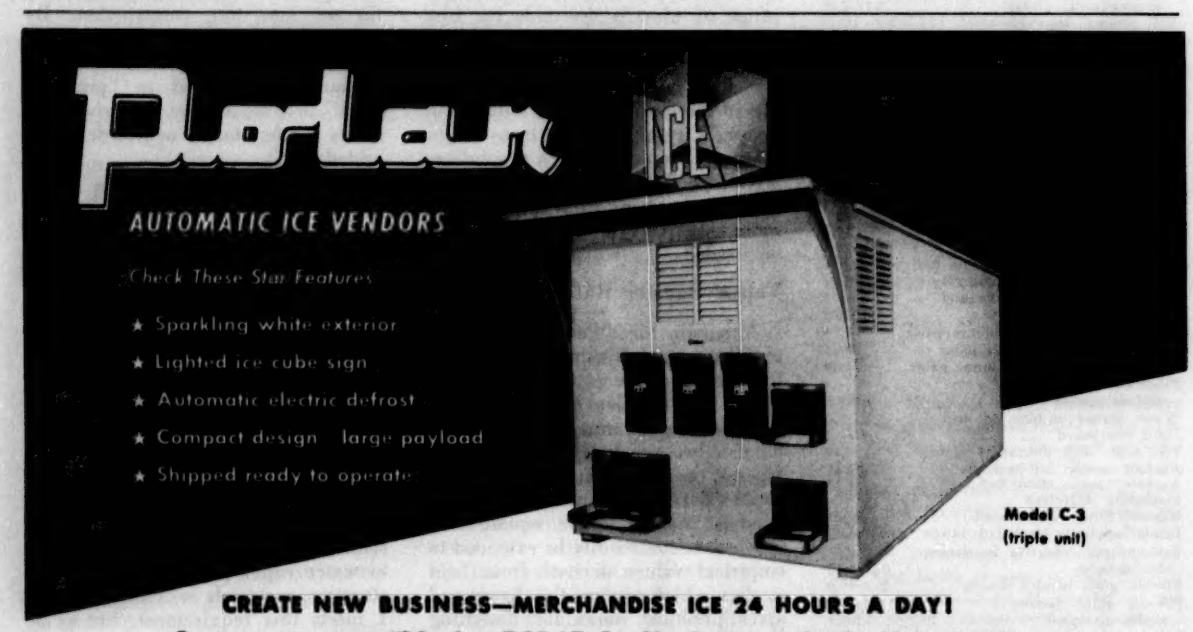
Rooms having dew points above the pressure equalization line should be designed in the same manner. These will specify, of course, a better vapor barrier on the inside than on the outside surface. Certain fruit storage rooms in these operating temperatures, however, pose another problem. They often do not operate through most of the summer months. The design approach for these structures requires a "blanking-off" of such inoperative periods on the vapor pressure graph. The vapor barrier requirements then become quite evident as pressures are predominantly outward, calling for a vapor barrier ratio of at least 1 to 16, which emphasizes a good inside barrier.

Operating Data Book — Fifteenth Edition Published by NAPRE

COMPLETE version of papers given both before NAPRE's 45th Annual Meeting November 1954, New Orleans, and the recent Midwest Regional Educational Conference, April, 1955, Chicago, are contained in the 15th annual edition of NAPRE's Operating Data Book, published this month. Articles range from humidity control and high velocity air distribution, to accident prevention and insurance service.

Discussions are also included on reappraising of plant equipment for modern food processing, the centrifugal compression of NH_3, applications of automatic controls, and reports on heat pump installations in Chicago and Indianapolis. Water conservation, sanitation, freezer tunnel evaporator problems, pharmaceutical plant air conditioning, and electric maintenance articles also appear in the 1955 version. Insulation problems and applications are also included.

Single copies of the 9x12-in Data Book are available at $2.50 each.



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From the President's Desk

Membership Drives Principal Spring Activity
Chapter Trophy and Nominating Group Announced

OUR Association's drive for membership in the Refrigerated Warehouse Industry is continuing to produce results. The national secretary, Dick Kelahan, and the membership chairman, Bill Orton, have been very busy taking care of the requests for membership-at-large status. They have been successful in getting better than 15 percent of the prospects.

Local chapters have now been working over a month on prospects sent to them by Orton. Some chapters are reporting good success; others have not been heard from, but it is presumed they have been working hard.

Chapters that have had success report they planned their drive by dividing the list of prospects between their own membership committee, or assigned them to members who are able to get out in the field. Members made personal calls and sometimes several follow-ups before getting the application signed.

Free Feed Incentive Sparks Texas Drives

Down in Texas, National Board Chairman, R. A. O'Neill, reports that Rio Grande Valley Chapter has a contest going 'tween the Upper and Lower Valley towns which comprise the group. The contest is not only based on new members obtained in our two current drives — Cold Storage and Public Air Conditioning — but also on attendance at chapter meetings. The losing side will eat beans, cornbread, and drink warm water; while the winning side would eat steaks, french fries, etc., and drink cold beer or soda.

New Chapters Forming

A tremendous interest in new chapters has resulted as a by-product of this membership drive. Right now there are organizational efforts in the following areas by these members, whom we shall call sponsors:

Philadelphia Chapter: Erich B. Utescher, The Philadelphia Warwick, 17th & Locust Sts., Philadelphia 3, Pa., and William Gretz, III, Wm. Gretz Brewing Co., 1536 Germantown Ave., Philadelphia 22, Penna.

Indianapolis Chapter: Anthony E. Wochna, Indianapolis Term. & Ref. Co., 1315 E. 36th St., Indianapolis, Ind.

Kansas City Chapter: Leland Kenagy, Railways Ice & Service Co., Argentine Station, Kansas City, Kans., and John G. Muller, Railway Ice & Service Co., 905 N. 7th Street, Kansas City, Kansas.

Denver Chapter: Marcus A. Florida, 8025 W. 9th St., Lakewood 15, Colo.

Sioux City Chapter: William T. Miller, 2609 Ross St., Sioux City 3, Iowa.

Las Vegas Chapter: Thomas O. Russell, Jr., 1600 W. Commonwealth Ave., Fullerton, Calif.

Tampa, Fla., Chapter: Martin R. Smith, 1731 Watrous Avenue, Tampa, Fla.

Houston Chapter: Dean Emerson, Jr., P. O. Box 9353, Houston, 11, Texas, and Larry W. Banta, 114 Bayridge Rd., La-Porte, Texas.

Richmond Chapter: Chas. F. Kries, Jr., Box 116, Irvington, Va., and Herman J. Duke, 3108 Sunset Ave., Richmond, Va.

Sydney (Australia) Chapter: W. G. Cropper, Thomas Andrew, James Kenny, Life House, 40 Millers St., North Sydney, Australia.

Top Brass Trophies Offered

Being a little selfish, I would like to see all these chapters get their charters during my administration; and Leroy Etzel, Vice-President, figures that if I don't get my wish, he will. So, the two of us are each supplying a trophy to provide a fast-start incentive for new chapters in our Association.

The trophies will be two gavels made personally by myself and will carry appropriate inscriptions for the two chapters that come up with the highest number of points under the rules given. The object of these rules is to equalize the chances of winning between those potential chapters that have been working for some months and those who have just started, or will start in the near future:

100 points to be given for receipt of the application for the charter at national headquarters, with the basic minimum number of members (10 active); 100 points to be given for each member over the minimum number; then the total of these points is to be divided by the number of weeks between the first organizational meeting of the chapter and the date that the formal application is signed up and ready for presentation.

The presentation will of course follow at a date convenient for the chapter, and when an appropriate officer of the Association can make the presentation and installation of officers. The trophies would be awarded at the next National Meeting in Los Angeles, November 8-9-10.

Nominating Group Appointed

Complying with precedent and in accordance with suggested procedure in the "Manual of Duties for Officers", as President, I am pleased to appoint the following past presidents to a nominating committee: Leo J. Vivien, Chairman, New Orleans; Alvis J. Clay, Memphis; A. R. Carlson, Chicago; E. T. Quinn, Los Angeles, and Angus M. Casberg, Edinburg, Texas.

Previous experience has shown that circumstances often prevent a full and representative committee from attending our national convention and completing a final report. Therefore, the following two alternates are appointed to act in the absence of any committeeman at our annual meeting: Erich B. Utescher, Philadelphia, and Howard H. Peterson, Yakima.

Responsibility of this committee is to prepare a suggested representative slate of officers for NAPRE for 1956, for presentation to the delegates at the Convention on November 10, 1955, at Los Angeles. Their recommendations are not binding on the delegates. However, they do render service in ascertaining which active members are available for office, look into their qualifications, and otherwise prepare data which will help the delegates determine the fitness and ability of the nominees.

NAPRE's Board of Directors, consisting of the Association's six officers and six directors, are elected annually, with exception of the Secretary who is selected by the Board. In the past, the top elective posts have been filled by promotion, directors having risen "through the chairs" on a merit basis. It is expected that this precedent will continue to be observed with regard to Chairman, President and Vice-presidents. However, names of the nominating committee are published here with the hope of encouraging all members to give the committee the benefit of their views between now and our Fall Convention.

April and May chapter reports indicate Tacoma, Tulsa, Corpus Christi, Rio Grande, and New Orleans, enjoyed Larry Benedict's film production of the 45th Convention. Here's the June schedule: Memphis — June 1; Green Bay — June 22, Detroit — June 14; Milwaukee — June 29.

Regis Embser

NAPRE Chapters Revive Regional Educational Conferences

PRIOR to World War II, it was the custom for sectional units of NAPRE to hold short educational conferences each Spring. These conferences provided chapters in each region with an opportunity to compare their educational programs and benefit from the more successful practices employed in the various chapters. It also provided a forum for discussion of mutual chapter problems, at mid-term. There was no waiting for the Fall national convention where national problems predominated over local and regional discussions.

The educational conference put members on the speaker's platform, thereby encouraging them to develop their ability in expressing themselves. The regional meeting also provided the opportunity of bringing practical information on timely refrigeration subjects to the attention of the entire membership at more frequent intervals, the very intent and purpose of NAPRE. Chicago Chapter has taken the lead in educational activities of this nature, having sponsored the first regional conference since the early 1940's. The Chapter was Host to the Midwest Regional Educational Conference on April 30 — May 1, Congress Hotel, Chicago.

Upper Left: Eugene Rytlewski, conference educational program chairman and Lester Winkler, Green Bay past president, take on a few questions from the floor. Upper Right: Conference Chairman Bert C. McKenna, Chicago introduces H. B. Howe, president, Howe Ice Machine Company, who welcomed out-of-town delegates and guests. Lower Left: The Rev. Terrence Thomas, OFM, pastor of St. Peter's Church, downtown Chicago, opened the conference with an invocation. Lower Right: Al Kraus, maintenance, New City Packing Company, Chicago, with welding and cutting set he won at conference session, Sunday, May 1.

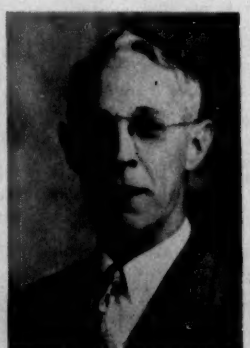
Papers Presented

"Water Conservation, Practically Speaking", by J. C. Rehard, began with a short summary of the reasons for condensing refrigerant. The relation and importance of the condensing process to the refrigeration cycle were mentioned along with facts pertaining to the popularity of water as a condensing medium. Some of the details concerning the shortage of water that has developed in some localities and is developing in others, were included and the principles involved discussed. Examples of already existing conservation measures are given. The fact that the refrigeration industry is called upon to bear a large portion of the water conservation burden was also dealt with.

Practical aspects of water conservation as it applies to refrigerating systems and some of the means to accomplish it were considered, with emphasis particularly on its application to existing systems. The methods of condensing and their application were briefly analyzed along with their development and relative merits. Some of the practical problems involved in the application of water conserving devices were considered.

A concise report of a refrigeration problem and its solution by conversion of the system to low side liquid ammonia recirculation is given in "Freezer Tunnel Evaporator Problem and Solution" by Harvey A. Wishart, The Larson Co., Green Bay, Wisc. The problem involved ultra

Paul F. Northam



John C. Rehard

Harvey A. Wishart

high superheats, extreme and unusual wear of compressor parts, utilization of only 2/3 of coil surfaces for liquid-to-coil contact, dehydration of product, and overall inefficiency. Wishart and his company are convinced that their solution is correct, and relate these experiences for benefit of others in the industry.

"Year-Round Air Conditioning for Pharmaceutical Manufacturing" was presented by Paul V. Northam, Assistant Power Engineer, Miles Laboratories, Inc., Elkhart, Indiana. Design and operation of a 1200 ton ammonia plant used principally for process humidity control, was explained. Colored slides picturing the machinery building and its equipment, the process plants served, and the air conditioning units, illustrated points in the talk. Also discussed were expansion difficulties, described as "growing pains", and the firms maintenance program. In addition Miles' refrigeration and air conditioning equipment, their engineers have under their jurisdiction, a steam generating plant, 13 air compressors, 9 wells and chlorinating equipment, stills, deionizers and auxilliary equipment.

Fourth paper selected by the Midwest Committee and presented by its author was "Electrical Wiring and Maintenance Problems Encountered". This discussion by Frank Vitt, electrical maintenance engineer, Swift & Company, National Stockyards, Illinois, dealt in some detail with fusing and protection of control circuits. The speaker also covered the protection of motors and their supply circuits, and pointed out the current changes being made by NEMA in motor frame sizes. He also discussed cleaning and maintaining contact surfaces of various controls, including the cleaning of fuse receptacles and clips. He cited insulation resistance figures for ground tests in connection with certain size conductors. His advice to maintenance engineers on how to go about looking

Honored guests, their ladies, and conference officials at dinner presentation. Standing: Ray T. Burns, national director, assistant conference director, Detroit and Mrs. Burns; John W. Neff, national past president and honorary member and Mrs. Neff; Mrs. Burt C. White; E. H. Burge, Chicago; Burt C. White, honorary member, Detroit; Seated: Hubert V. Hess, toastmaster, Chicago; Bert C. McKenna, National vice-president and conference chairman, Chicago, and Mrs. McKenna; George B. Bright, honorary member, Detroit; Louis P. Mantz, past national president, Pittsburgh; Mrs. E. H. Burge.

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for trouble was "look for the obvious or commonplace".

About the Speakers

Son of a small town business man, born, raised and schooled in Newcomerstown, Ohio, John C. Rehard is presently an engineering sales executive and consultant. Advanced schooling included work at Ohio State University, the NAPRE refrigeration course (in the 1920's), air conditioning studies through ICS and several engineering courses through the University of Michigan extension in Detroit. He is registered as a professional mechanical engineer in Michigan and Ohio.

Member Rehard started in the refrigeration industry in 1924 with an erecting crew, and operated and maintained refrigerating plants for many years. He joined Detroit Department of Buildings and Safety Engineering in 1937, and became chief safety engineer ten years later. In addition to articles for engineering publications, he has actively participated in the drafting of local and national codes and standards including the ASA. B-9 refrigerating code. He is a member of NAPRE, ASRE, ASME, Building Officials Conference of America, Engineering Society of Detroit, and the National Fire Waste Council.

Harvey A. Wishart started working for The Larsen Company, Green Bay, Wisc., in April, 1937, as an over-the-road semi-truck driver, and was later promoted to garage foreman. At this time he got interested in refrigeration and started taking an I.C.S. correspondence course. When three-fourths of this course was completed, The Larsen Company took over their first cold storage warehouse and he was placed in charge. Since that time they have added three cold storage warehouses and two freezer tunnels to his responsibilities.

Mr. Wishart has been a refrigeration engineer for the last 11 years, and a member of NAPRE since July 30, 1946. His son, Gordon, is a charter member of the Green Bay Chapter, founded by the senior Wishart.

Practical describes the career of Paul V. Northam. A 1933 graduate of Elkhart High School, he majored in machine shop and mechanical drawing; started working for Miles Laboratories, Inc., in 1935; and took a foremanship course with the Emerson Institute. He received first practical experiences and training in refrigeration and air conditioning from Wm. Kincaide, Miles chief power engineer while moving, installing, testing and operating their equipment. During World War II, he served with the Army Corps of Engineers where he took a diesel engine mechanic course. Paul studied refrigeration and air conditioning with ICS and states that much valuable aid and instruction was received from the engineers of the Westerlin and Campbell Company, formerly York representatives in the Chicago area.

Frank Vitt's training and experience, according to St. Louis chapter representatives, qualified him highly for presenting such a paper. He studied engineering at Fenn College, Cleveland, Ohio, worked 10 years in electric maintenance for Dupont and two years for St. Louis Independent Packing Co., and has been the chief electrician at National Stock Yards for seven years.

Field Trips

Following presentation of the four selected papers, delegates and guests of the conference were afforded an opportunity to make a field trip of their own selection. Five trips had been arranged. Most popular, from the number of attendants who participated, was the tour of the air conditioning plant and system of St. Peter's Church in downtown Chicago. Perhaps the personality and background of the Pastor, Rev. Terrance Thomas, who gave the invocation at the start of the conference, had something to do with the number of delegates who signed up for this tour. This Franciscan Priest is architect and building superintendent of his Order for 13 Midwestern states, and is actually responsible for the church construction and engineering features. Deane Perham and Bill Tiffin of Vilter Manufacturing and Ideal Electric, respectively, made the arrangements for the trip. The ladies accompanied the engineers on this field trip.

Another timely tour was that to the Continental Freezers of Illinois where visitors toured the new low temperature annex opened just a few days previous to the conference. Jack L. Hemery, general manager and Joseph A. Farrell, chief engineer, guided a large group of the delegates through the new installation, through a unique expandable freezer unit and other features of this modern Chicago cold storage plant.

Jay R. Watson, Ideal Electric representative, guided another tour through Marshall Field & Company, department store air conditioning plant. Frank Bartilotta, York Corp. engineer, guided still another group through the new additions and current construction at the Congress Hotel. The tour was arranged by B. E. Nydam, construction superintendent, Pick Hotels.

Still another group of engineers travelled to Chicago's north side to inspect a heat pump plant just finishing its first year of operation in an office building. The plant tour of Midland Enterprises Office Bldg. was under the guidance of Ion Caloger, consulting engineer. This plant is an earth-heat source with a grid buried approximately four feet below the surface of the parking lot at the rear of the office building. An alcohol and water "brine" mixture is used as an intermediate heat transfer media. Freon-12 is the refrigerant. The plant is used for heating in the winter months and reversed for cooling during the summer.

Panel Sessions

On Sunday morning, May 1, the conference engaged in a unique breakfast-luncheon arrangement with three panel discussions running consecutively. Other papers contributed for the conference were reviewed briefly for the benefit of the delegates, and an announcment made that these papers with the field trip reviews were to be published in the Annual of the Association. The chapter clinic on local problems followed. National officers made up the panel and acted as a clearing house for passing on suggestions to the chapters on how to solve their problems. Suggestions were based on experiences of other chapters. The question box session on items of general interest and on the previous day's papers followed. The conference adjourned at 1:00 pm Sunday.

Social Events

Highlight of the conference social events was the dinner on Saturday evening, April 30, honoring 50-year men of the refrigeration industry. Individuals cited for their contributions were named earlier by the various chapters participating. George B. Bright, Sr., of Detroit, was presented with a national honorary membership. Roy T. Burns, national director, presented the scroll on behalf of the association, following an introduction of the honored member by his son, George B. Bright, Jr.

Other 50-year men honored were Louis P. Mantz, a past national president of the association from Pittsburgh. Mr. Mantz was introduced by the national secretary, since other Pittsburgh delegates had been detained. E. H. Burge of Chicago was introduced by Don A. Parkhurst, who

cited the contribution made by Mr. Burge in the refrigeration industry throughout the Midwest in his more than 50 years in this field. John W. Neff, an honorary member and past president of NAPRE, member of the Chicago chapter, was presented by Jay R. Watson. Burt C. White, national honorary member, was introduced by L. L. Adams, secretary, Detroit, who jokingly commented that the only thing bad he had to say regarding Brother White was the fact that he had turned over the reins as secretary to Adams. Hurbert B. Hess, Creamery Package Company, was toastmaster for the affair.

The breakfast panel sessions were enlivened by a special drawing for a complete welding and cutting outfit donated through the courtesy of Johnson Welding Equipment Company, Inc., Chicago, distributors for Smith Welding Equipment Corporation, Minneapolis, Minn. Al Kraus, maintenance man, New City Packing Company, South Water Market, Chicago, was the recipient. On Saturday at Noon, the ladies were quests of Marshall-Field & Co. at a luncheon-fashion show in the famous English Room.

(Continued on page 55)

News Notes and Chapter Activities

St. Louis

BILL ALLEN

THE LARGEST copper tube manufacturing facility in the world is the Lewin-Mathes mill at Monsanto, Ill. It swarmed with NAPRE people from St. Louis Monday evening, March 21, under the watchful eyes of competent and cordial guides from the Lewin-Mathes technical staff.

Starting where the raw copper and dirty scrap are dumped into roaring furnaces, through the big electrolytic cell house, then the drawing mills where gleaming shafts emerge as perfect copper tubing, Bernie Stuckenmeyer rubbed his chin and expressed the reaction of all, "It goes in so dirty, and comes out so clean."

The tour ended at the plant cafeteria, where a generous buffet supper was laid with the compliments of Meyer Marx, Vice-President of Lewin-Mathes. Mr. Marx introduced his staff as hosts of the evening, described the plant and its operations, and answered a barage of questions from his interested visitors.

Thanks to Al Loeffel whose suggestion resulted in the invitation to this outstanding plant, the meeting was the best attended affair of the year. Al has put life into the NAPRE program on many occasions. He was chairman of the National Convention Committee in 1946, instigated the Kennard plant tour, and has contributed often to interesting educational programs. Ed. Hughes, chapter secretary, won the attendance prize, an NAPRE lapel emblem. Bill Kublin's number was drawn, but he couldn't be found, not even under the table.

Here is the standing of St. Louis' Membership Teams to date: The Old Maestro, Capt, John Dabbs, is playing real hot music with his St. Louis Blues. But look out, Captains Gene Kessler and Gurdon Uplinger may change the picture any day, with clean-up of renewals and a first full of new applications.

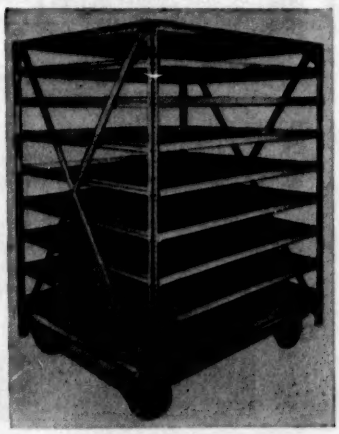
Father and Son Department: Guests of Henry Proemsey at the last meeting, John S. Forman, and his son, Kenneth S. Forman, submitted applications for membership. John is an engineer from way back, but fell by the wayside and is now Vice-President of Mt. Olive & Staunton Coal Co. Kenneth is in the engineering department of the First National Bank.

Colton

HARRY BONTER

THE MEETING of April 13 was postponed one day to avoid conflict with the safety meeting of the Southern Pacific Railroad and the Pacific Fruit Express that came on our regular evening. On the following night the meeting was held at the

FREEZER TRUCKS



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PARKERSBURG, W. VA.

Pacific Fruit Express ice plant. Plant manager, L. G. Schroeder, invited members and friends to an inspection tour to see the remodeling that has been done in the plant to bring it to more modern operation. After the trip through the plant, the group went on another inspection trip of the new icing deck east of the plant. This is the icing operation described in the November 1954 INDUSTRIAL REFRIGERATION, page 19.

The ice is delivered from the plant in refrigerator cars to the unloading deck, then transfered to the icing deck crushing machines and delivered in the ice bunkers of the cars. The salt machines follow the crushers. All motors and signals are controlled by the operator on the crusher. The deck is one of the modern type, seventy-two cars capacity. The group then enjoyed the hospitality of Mr. Schroeder at a lunch in the deck locker room.

Memphis

CHAS. CONLEY

THE MEETING of Wednesday, April 6, featured our instructor, H. L. Todd, as principal speaker on the subject "Absorption Systems". He explained how the various types of these systems worked, their advantages and where used in home refrigerators, railway cars, and various plants. A lot of interest was shown in the talk. Lee Stewart, Asst. Engr., B. Lowenstein's Bros., was elected to membership. On Wednesday, April 20, the chapter's instructor reviewed the care of compressors and refrigeration systems from a paper published recently in an industry trade paper.

Rio Grande Valley

ARMIN DONEIS

IN PREPARATION for the annual election of officers at the next meeting, Angus Casberg was named chairman of the nominating committee. He named Encarnacion Contreras and Rube Keener members of his committee, and they prepared a slate of officers. Because of the serious prolonged illness of President B. F. Wilson, Jr., it was voted to pay his dues out of the chapter treasury. Vice-president Dan Chapman, has also been on the sick list, recuperating from a spinal operation, so Secretary Armin Doneis served as presiding officer as well as instructor and secretary. He pleaded with the members present to encourage better attendance, and asked other members to accept some of the responsibility for the smooth and successful operation of the chapter. He reminded the members that any organization that becomes too dependent on any one member is in a bad way, especially if that member has no special talents, and is merely an uninspired workhorse that just keeps plodding along.

Seattle

JOHN GRAINGER

WASHINGTON'S No. 1 Chapter held its April meeting on Friday, the 8th. Speaker for the evening was M. R. Brody of the York Corp., who gave as his topic "The Selection and Performance of Booster Compressors". Mr. Brody gave a brief resume of the booster compressor, how it came into being due to the need of low temperatures in quick freezing. Somewhere about 1920 York took a 10 by 10 compressor and installed lighter valves and used it as a booster compressor. This proved quite successful at the time. They next developed the two-stage compressor with an intercooler and then the rotary booster. It was pointed out to members that it would take a compressor with a compression ratio of 20 to 1 to do the same work as a rotary compressor of equal capacity.

The speaker then brought out the principle features of a rotary booster compressor: high capacity, ability to handle high gas volume with small space; small size, high rotative speeds permit smaller dimensions; positive lubrication, mechanical lubrication supplies positive pressure lubrication to all internal parts; mechanical shaft seal, double balanced seal, tensioned with ring springs, it has only one rotating part, the collar locked to the shaft by means of a steel ball; oil seal pressure regulating valve, keeps the pressure in the seal at the lowest possible positive pressure above the atmospheric pressure; blades or sliding vanes, laminated asbestos impregnated with phenolic resin and heat treated, blades fit into rotor slots and are held out by centrifugal force; unloaded starting, rotary compressor pumping does not begin until centrifugal force causes the blades to move outward to the cylinder walls. This booster can be used with "Freon-12," "Freon-22" or ammonia systems.

The Chapter instructor, Bob Harrison, gave as his lecture Chapter 3 of the Guy King course, on Refrigerants. This proved so absorbing that not until the end of the lecture was it discovered that an hour and fifteen minutes had passed.

Dallas

JIM GLOVER

THE FIRST meeting of the month, April 4, brought a nice turnout to Alford Auditorium. E. R. Hallowell conducted the lesson on various types of expansion valves and their uses. Principle joint brought out with regard to choosing these valves, was that the proper type of charge for the type of refrigerant with which they are to be used, be noted. Also discussed were refrigerants; their boiling points, characteristics, and actions under different pressures.

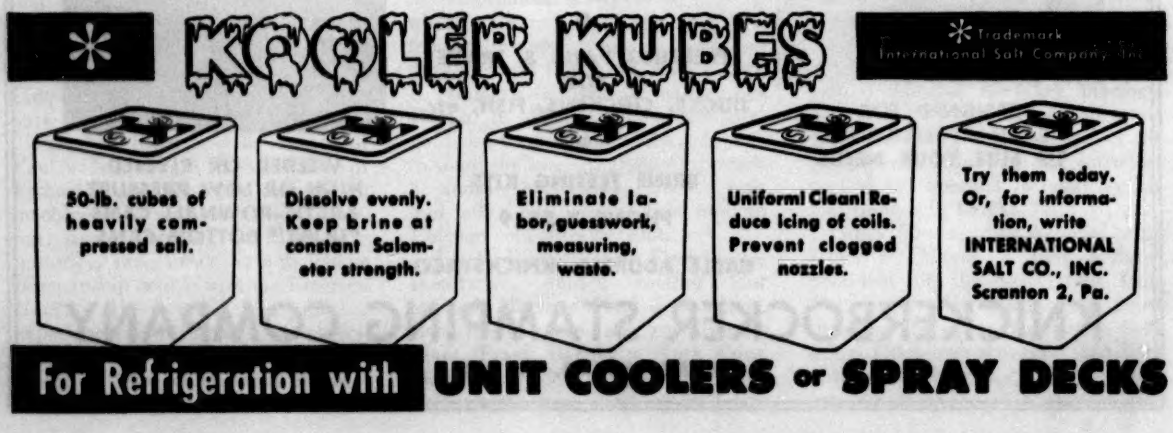
At the second meeting on April 18, we met at the Oak Farm Dairies for a tour of the plant. O. K. Irvine gave a drawing board lecture of the plant's layout and operation. They have just put into operation their new machinery for an ice cream hardening room (80 x 120 ft.) which is held at minus 30 F.

After the lecture (and a treat of ice cream), we were taken on a tour of the engine room section of the plant. Bro. Irvine did a magnificent job of explaining the plant operation. They have located all their controls, which are mostly automatic, in the engine room for convenience and easy accessibility to checking and repairing. Members also had the pleasure of touring the milk and ice cream processing section. This operation was explained in detail by Bob Spencer of Oak Farms. Our many thanks to Bro. Irvine and Spencer for arranging this fine tour.

Greater Dade County

CHAS. MONEYPENNY

AT THE meeting April 18, we learned that the educational program seems to be stirring the members up, resulting in pretty good attendance. Our electric school is taking up one night a week until September. Most of our chapter members are attending. This school is for maintenance engineers. Dade County's Electric Code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says "Any person maintaining or repairing anything electric, must have an electrician's license".

Everyone was pleased with the write-up of our charter presentation in the April INDUSTRIAL REFRIGERATION. Walter Smith, our vice-president, has been unable to attend meetings. He therefore resigned, hoping to try another year when obligations elsewhere are lighter. He was succeeded by Harry L. Quinn at a special election. It was also decided to divide the duties of vice-president, and a second vice-president was elected. He is Richard H. Wiskman.

Chicago

BILL O'REILLY

OUR instructor for the preliminary class on March 8, was Dick Zach, York Corp. We thoroughly discussed the chapter on "Lubrication." Samples of oil in its different stages were supplied by Zach and Joe Farrell of Continental Freezers. While the samples were being examined, some of the members asked questions or had problems concerning lubrication. Zach answered these and then answered the questions at the end of the chapter.

Mr. Zach introduced Howard Wolfberg, York Corp., as the principal speaker. He gave a very interesting talk on "Controls for Refrigeration Compressors." His lecture will appear in Industrial Refrigeration during the summer. There were two applications for reinstatement; Frank Krez, Central Cold Storage Co.; D. R. Walser, Wright Chemical Co.

At our preliminary class March 22, John Range, Burge Ice Machine Co., was our instructor. Range covered the chapter on "Defrosting Methods", covering hot gas, water spray, heater and the so called various forms of brine spray methods. He outlined the good and bad points concerning these methods, explaining that where one method of defrosting is satisfactory, it may not be desirable in another. Bert McKenna drew a diagram and explained the "Thermobank" system of defrosting.

Nick Downes, program chairman, introduced George Podrebarac and Henry Wagner, both gentlemen from the Crane Company. They showed a film called "Choosing the Right Valve". This film explained the functions of the globe, gate and check valve. It showed how to apply the valves and how to install them. The regular meeting was opened by President Art Clementson. Following roll call and minutes of the previous meeting, Bert McKenna introduced Carl Schartel of the Voss Valve Co., New York. He was a guest for the evening. There were two applications for reinstatement: Charles J. Duennes, Vice-Pres., Inter-Ocean Oil Co.; William Schroeder, Illinois Bell Telephone Co. Both applications were voted upon and accepted.

At our April 12 meeting, a cold buffet dinner was served in the Inspection Room, Central Cold Storage Co. The usual preliminary class was not held because of the full schedule planned for the evening. The regular meeting was officially opened by Pres. Clementson. Bert McKenna exhibited a complete welding set except for the hoses, which the Johnson Welding & Equipment Co. donated to the Educational Conference. Bert read a letter he received from Regis Gubser, congratulating everyone from the Chicago chapter who participated in the charter presentation to the Milwaukee chapter on March 24, 1955.

As an added attraction for the April 12 meeting, Johnson Welding Equipment Co. Inc., demonstrated the latest Oxy-Acetylene apparatus manufactured by the Smith Welding Equipment Corp., Minneapolis, Minn. Johnson Welding also presented new electrodes and applications. Handy & Harmon, manufacturers of silver alloys and fluxes presented the film, "Fundamentals on Silver Alloy Brazing."

This movie outlined six steps to follow in silver alloy brazing: (1) Cutting and fitting—clearance should not be more than .005"; (2) Cleaning—surfaces must be free of oil, grease, rust or oxides. Carbon Tetrachloride application with a brush is an effective method of grease removal. Emery cloth is used to remove rust and oxides; (3) Apply flux to metal; (4) Supporting the assembly—before brazing make sure assembly is carefully aligned and adequately supported; (5) Proper heating of metal—when brazing a pipe into a fitting, heat the pipe first, so that the pipe expands and carries the heat

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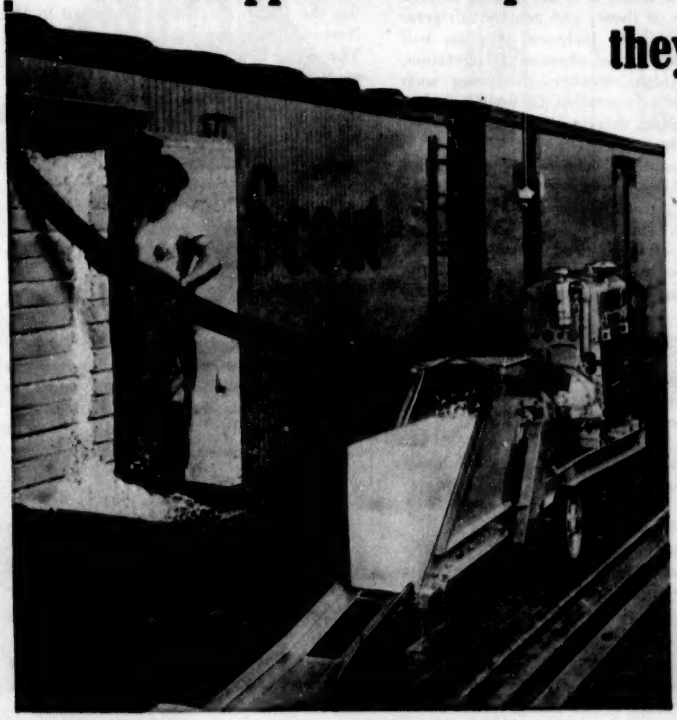

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uniformly to the end inside the fitting. The object is to bring pipe and fitting up to equal heat together for application of silver brazing alloy; (6) Cleaning after brazing—wash off flux with water. Use a brush if necessary for large inaccessible lines.

It was learned that a joint can be taken apart by simply following the steps (2) through (5) for original brazing. Some of the guests present at this meeting were W. T. Johnson, President, Johnson Welding & Equipment Co., R. T. Jones, Director of Training & Metallurgist, Fred A. Lasck, Field Engineer, Handy & Harmon Co., Les Blackford, Sales Manager, and John Ardagh, Field Engineer, Johnson Welding & Equipment Co.

Bert McKenna introduced George Rockwell, Field Representative, Industrial Sales Division, Remington Arms Co., and George Greene, Nelson Stud Welding, Division of Gregory Industries, Lorain, Ohio. Rockwell gave a demonstration of the Remington Stud Driver Model 450. The construction, operation and safety features were explained. This driver can inject a stud into lumber, cement and steel, which Mr. Rockwell demonstrated. Its features are that it is faster, more dependable, safer than convention methods and it is portable. The group then adjourned to the Maintenance Shop, where members were given demonstrations on welding and brazing, and also tried their hand at either one.

On April 26, the educational session was called to order by Dick Zach, at the Chicago Engineers Club. The session concerned a discussion on compressor drives. This included, motor, steam turbine and engine driven. Considerable discussion was given to the correction of power factor and the reason for doing same.

Speaker for the evening was C. L. Kleinschmidt, sales engineer, York Corp., who discussed various types of guest room air conditioning for hotels. His talk included: (1) Conventional duct type system; (2) Induction type unit system employing high velocity to induce air circulation; (3) Room units with own motor driven fan to provide circulation, and coil heating or cooling supplied from a remote plant. Advantages and disadvantages of each type were discussed. It was also pointed out that there are other possible means for providing room air conditioning and varying degrees of control. Following the talk, a movie was shown describing York Corp. plant and organization.

Our president, Art Clementson, called the regular meeting to order. John Neff presented to the Chicago chapter a hand made, walnut gavel. Bert McKenna announced that the seller of the most tickets on the welding outfit was to be awarded a table model clock radio. As it turned out, Earl McMichaels won, having turned in over 28 books of stubs.

Unofficial reports of the recent Midwest Conference held here in Chicago, indicate a financial success. At least the committee repaid the chapter all of the "advance" we made them.

Los Angeles

FRED HERR

RECENT development and trends in modern air conditioning were discussed in the major technical talk at the April 20 meeting of Los Angeles Chapter, NAPRE, by Stephen A. Shea, sales engineer of the Carrier Corp., Los Angeles. Mr. Shea presented an exceptionally complete talk on what has taken place during the past year or so in the air conditioning sector of the refrigeration industry. He covered various divisions—air conditioning in homes, hotels, restaurants, and different types of factory and industrial buildings. He used blackboard drawings and slides to highlight certain parts of his discussion.

The preliminary class, which preceded the business session, was conducted by Guy King. The subject was Chapter 23 (on brine refrigeration) of King's textbook *Basic Refrigeration*. D. P. Perry, B. Mauldin and Floyd L. Stern were voted into membership.

A meeting of the general convention committee was held in the offices of the Union Ice Company on the night of April 27 to map further plans and correlate those already decided upon, for the NAPRE convention in Los Angeles next November. Twenty members of the general committee were present, including General Convention Chairman W. R. Burnett; vice-chairmen Frank Eccleston, Edgar M. Marrs and Dale Rycraft; National President Regis Gubser, and Chapter President Elmer A. Johnson.

It was announced by Gubser that he, Dean Harold Hayes, and the National Secretary had come to definite conclusions as to the theme or type of technical talks to be presented at the November convention, although not all speaking spots have been filled. While it is planned to include some talks on theory and general refrigeration practice, the technical program will stress the *industrial* phase of refrigeration, with individual speakers discussing such subjects as refrigeration in various industries—brewing, dairying, cold storage, food industry, etc.

Entertainment Committee Chairman Ed L. Nelson reported good progress is being made on setting up plans providing for the lighter side of convention activities. A number of parties and exhibitors' frolics are in the making, with settings in the Ambassador Hotel. Plants are still incompleted for a major entertainment feature beyond the confines of the Ambassador, with possibly the Moulin Rouge or one of the other well known Hollywood or Sunset Strip night clubs as the locale. Members of Los Angeles Chapter have set themselves the task of trying to present a convention "bigger and better than the one New Orleans put on last year", which every one from National President Gubser down admits is quite a goal.

There was no business meeting or educational session the evening of May 4. Instead, some 100 members and guests journeyed to the plant of Refrigeration Engineering, Inc., (Recold), on East Slauson Avenue, Los Angeles, for one of several field trips the chapter schedules each year. Inspection tours of the refrigeration manufacturing facilities were made under the guidance of Chief Engineer Daniel D. Wyle, and Sales Engineer Harold H. Halls of the Recold organization.

New Orleans

MAX SOFER

FOR our first meeting in April, C. C. Carter, Jr., General Electric Company, Lamp Division, talked about new lamp developments. Carter demonstrated improvements recently made by his company in the use of a differently constructed filament support. Not only did it prolong lamp life but also boosted the output of light per watt consumed. A bulb consuming 60 watts is now able to provide candlepower which used to require an input of 100 watts. A short film showed the membership how a business can profit by making use of light furnished from fluorescent tubes.

Our second meeting on April 27, was widely advertised in local magazines and newspapers as well as by our telephone committee headed by D. H. Swails. The results were very gratifying. We actually had "standing room" only. Guy King's course once concluded, was started again under the direction of Thomas A. Stokes. Stokes is a mechanical engineer for Cary B. Gamble and Associates. He is well known in local and national circles, having designed the heating, plumbing, refrigeration, and air-conditioning systems for numerous buildings and idustrial plants. Prior to New Orleans, Stokes was connected with Frigidaire, and formerly was superintendent and mechanical engineer for a national construction firm. Our membership was very pleased with the selection of such an able and popular instructor, and enjoyed his lecture. After the usual business meeting, Larry Benedict's film showing the California Delegation's trip to the New Orleans convention was presented. The color film showed the beautiful scenery on the road to and from our city giving a preview of what a New Orleans delegate can expect to see when he goes to California for the next National convention in Los Angeles.

Texas Coastal Bend

VERNON KUMMEL

ON APRIL 1, the entire study period was used to familiarize each member with the Mollier chart for ammonia. A refrigeration cycle at standard ton conditions was plotted and each part of the cycle was explained. So much interest was shown by the members, that we are to have one more meeting devoted to the use of the Mollier chart, to show how it can be used in everyday operations.

Our meeting on April 15 was taken up by the showing of the very fine film by L. H. Benedict of Los Angeles, Calif. Everyone enjoyed it very much. Our guests of the evening were Misses Vicki and Rose Weynand and M. R. Batey, chief engineer of the Robert Driscoll Hotel in Corpus Christi.

Our membership committee is working on prospects in the Galveston, Port Arthur, San Antonio and Port Lavaca areas.

NAPRE

Question Box

The National Educational Committee, NAPRE, answers monthly in this column, operating problems forwarded by members. The Committee appreciates answers from the field. Address questions and answers to Prof. Harold P. Hayes, Dean of Engineering, State Polytechnic College, San Luis Obispo, Calif.

More on Question 1043

Hot Gas Defrosting

QUESTION NO. 1043. A thermobank was briefly described in December Industrial Refrigeration article on Spreckles-Russell Dairy, Page 17, center column. Apparently this is a hot gas defrost system for blower type coils. How does it work? Are any simple diagrams available?—T.K., Edwardsville, Ill.

Editor's Note: An answer to this question contributed by D. L., San Luis Obispo, Calif., was published in April, Industrial Refrigeration. The question specifically refers to a plant described in the December '54 issue. D. L.'s answer pertained to the thermobank system for halogenated refrigerants, while the system described in December actually uses NH_3. The Question Box and IR regret this technical oversight. Published below is the manufacturer's explanation of the system functions in the subject plant. And, the reader not only derives the added benefit of another excellent reply, but his memory is refreshed on the main differences in these patented defrost systems with regard to type of refrigerant used.

ANSWER: The Ammonia "Thermobank" System is based on a modified form of the reverse cycle. It is essentially a combination of a hot gas defrosting system plus a heat exchanger in the suction line. This heat exchanger, the "Thermobank"

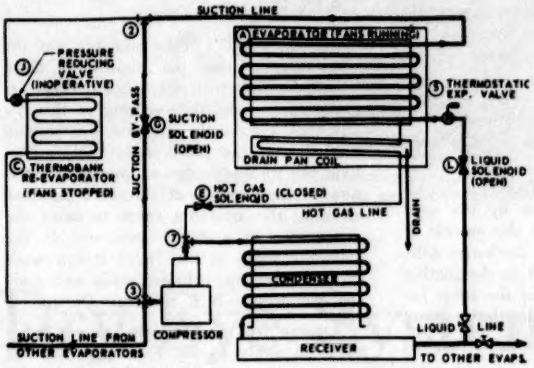

Fig. 1—Normal operation, NH_3 System

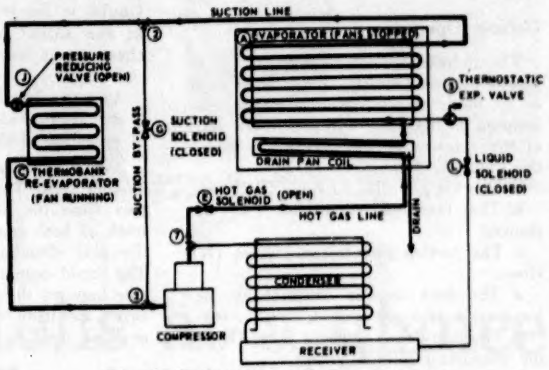

Fig. 2—Defrosting with Re-evaporator

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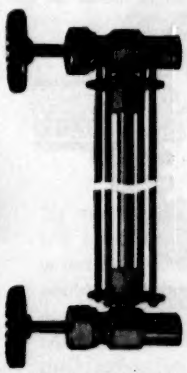
Precision Built



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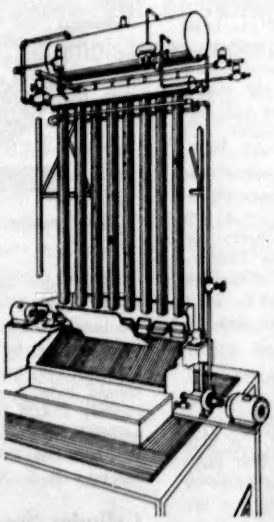

FRICK

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Re-Evaporator, serves to re-evaporate the liquid refrigerant condensed in the refrigerator during defrost.

Normal Operation

During normal operation (Fig. 1) the solenoid valve (E) in the hot gas line is shut. The suction vapor by-passes the Thermobank Re-Evaporator through a normally open solenoid valve (G). The fans on the Thermobank Re-Evaporator (C) are stopped. The high pressure refrigerant from the compressor is discharged into the condenser, from which it goes to the receiver and through a thermostatic expansion valve (5) to the evaporator coil (A). From the evaporator coil, it returns to the compressor through the suction line by-pass.

Defrost Operation

The defrost operation (Fig. 2) is initiated by a self-starting clock after three or six hours of compressor operation (depending on the timer setting). At the start of the defrost, the clock switch performs the following functions:

a. The hot gas solenoid valve (E) opens.

b. The fans on evaporator (A) are stopped.

c. The suction line solenoid valve (G) closes.

d. The fans on the Thermobank Re-Evaporator (C) are started.

e. The liquid line solenoid valve (L) at the evaporator inlet is closed.

During defrost, the high pressure refrigerant discharged from the compressor goes through the hot gas line to the evaporator (A). The hot gas line is in full contact with the drain line, keeping the drain line warm and permitting free drainage of water defrosted in the evaporator. The hot gas then passes through the drain pan of the evaporator (A) and from there enters the evaporator coil, by-passing the expansion valve (5). The hot gas heats the drain pan and defrosts the evaporator coil. In doing so, it turns into a liquid. The liquid refrigerant leaves the evaporator through the suction outlet and goes to the Thermobank Re-Evaporator (C) through the pressure reducing valve (J). In the Thermobank Re-Evaporator the liquid refrigerant is again evaporated, regaining from the surrounding air a new quantity of heat to be used for defrosting. The refrigerant vapor from the Thermobank Re-Evaporator is returned to the suction intake of the compressor. This cycle continues until the defrost is complete.

Post-Defrost

When defrost is complete, the timer switch shuts the hot gas solenoid valve (E), but the Re-Evaporator (C) is kept in operation for approximately four more minutes to make sure that any slugs of liquid remaining in the suction line are evaporated before normal operation is resumed. At the end of the post-defrost period (4 min.), the timer switch performs the following functions:

a. The fans on evaporator (A) are started.

b. The suction line solenoid (G) is opened.

c. The fans on Re-Evaporator (C) are stopped.

d. The liquid solenoid valve (L) is opened.

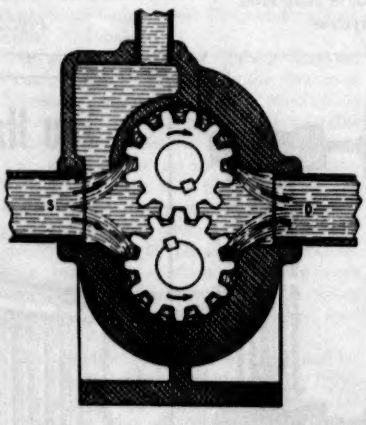
Normal operation (Fig. 1) is resumed. The timer switch is set at the factory but can be adjusted from 10 to 20 minutes. The post-defrost period is adjustable from 4 to 8 minutes.—O.J.N., Trenton, N. J.

Differential Pressure Drop Due To Gear Pump Wear?

QUESTION NO. 1054: We have two Flakice machines which operate on the recirculating ammonia principle. The ammonia pumps are rated as having a capacity of 35 gpm at 20 psi differential. However, our differential pressure has now dropped to 5 psi. Could it be from the gears wearing at the sides? What clearance should these gears have?—G.C., Nova Scotia.

ANSWER: The model to which you refer is the York Model LL 776. The principle of operation of these pumps is as follows:

A gear mounted on a driven shaft drives another gear. The liquid ammonia is carried from the suction side by the gear teeth of both gears around the outside of the gear chamber to the discharge side. The liquid cannot pass back to the suction side between the gears since the voids between the teeth are filled by the meshing of these teeth.



Cross-section, NH_3 Gear Type Pump

From the information presented, it would appear that the gears are undoubtedly worn, both on the gearing surface and on the side clearance. We recommend that new gears be installed. They should have a side clearance of approximately 0.0025 to 0.0005 inch with a diametral clearance between the gears and the body of 0.001 to 0.003 inch on diameter.—D. S., San Francisco.

Cylinder Scoring Problem

QUESTION NO. 1055: In my refrigeration plant I have several VSA machines taking suction from rotary boosters and discharging to an evaporative condenser on the roof. For two years now I have experienced no trouble with these machines. Suddenly I noticed scoring in the cylinders. I have checked against contamination, wear from the rings and possibly faulty valves, but have not located the trouble. We re-bored one machine and ran it six hours without the heads with plenty of oil topping. After replacing the heads we ran the machine for six hours and then opened it for inspection. The scoring had taken place all over again. One practical engineer has suggested that I leave the oil ring off. Another has suggested that I chamfer 1/64 inch off the top and more off the bottom of all rings above the oil ring. Could you give me a few hints or suggestions as to what might be causing this scoring? I believe that I can take it from there.—J.A.F., Chicago.

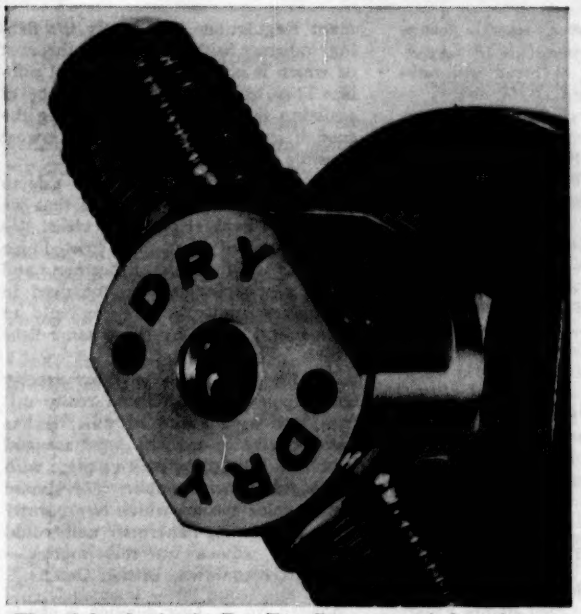
ANSWER NO. 1: It is probably not the rings which cause the trouble. If there was little wear with the original rings for a period of time, then scoring of the cylinder walls suddenly occurred, this scoring must be due to some other factor. Perhaps the trouble is due to improper operation of the controls at the flash chamber allowing the ammonia vapor to enter the compressor in a "wet" condition. If the ammonia vapor it too "wet" it can wash the oil from the cylinder walls and scoring can occur.—N.S. San Luis Obispo.

ANSWER NO. 2: This may appear ridiculous to reply to my own question, but your readers may be interested in the procedures followed in connection with my cylinder scoring problem. I consulted with engineers from the compressor manufacturer, our insurance carrier, and the lubricator manufacturer. Our joint investigations showed that the lubricating site glasses were cloudy and the operators could not determine readily the number of drops per minute being fed.

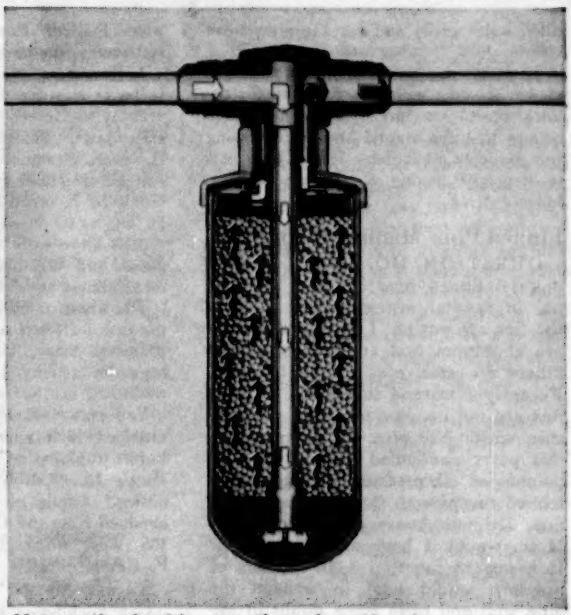
Further investigation proved that oil had replaced the glycerin in the lubricator site glass. When this occurred, it had been the engineer's habit to force more glycerin into the glass, displacing the oil, and again giving a reasonably clear liquid through which the oil drops could be observed. However, the glass clouded up again in a comparatively short time.

Apparently the glycerin had a slight affinity for our oil, or vice versa. Instead of the oil droplet passing through the glycerin, it apparently picked up a coating of the glycerin and small portions of the oil remained behind. A check on our lubricator showed glycerin in the lead lines to the cylinder walls and the main suction. We, therefore, assumed that the glycerin, or the combination of oil and glycerin, had brought about conditions in the cylinder which led to the scoring.

Our remedy was to clean out the lubricators thoroughly, including the site glasses, lines, etc. We discontinued using glycerin, replacing it with distilled water in the site glass. We feed 40 drops per minute (eight drops per minute to each lead, two leads to each cylinder and one to the machine suction). The machines have been running some number of weeks now without any indication of further scoring. The oil passes through the dis-



The *pink* color in the Dry-Eye Connector window changes to *blue* when T-Flo Cartridge removes excessive moisture.



Note path of refrigerant through uniformly round pellets of Andrite in the T-Flo Dry-Eye Cartridge.

Dry-Eye System tells at a glance if refrigerant is wet or dry

Once the Ansul Dry-Eye System is installed you can replace the T-Flo Cartridge without breaking the line.

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No more guessing—now you can tell scientifically if the refrigerant is *wet* or *dry*. If the Dry-Eye Connector window shows *blue*, the equipment is in a safe operating condition. If the window shows *pink*, excessive moisture is present. To remove the moisture, simply change the T-Flo Dry-Eye Cartridge. That's all there is to it.

Andrite, the drying agent used in the T-Flo Dry-Eye Cartridge, is superior to all other popular desiccants in the deep drying range. This is the range which determines the quantity of desiccant to be used. As for acid removal, Andrite will pick up 4.5% of its weight in acid when completely saturated with water. The extraordinary drying capacity of the T-Flo Dry-Eye Cartridge allows you, in many cases, to install smaller driers than the ones you are now using.

Test-try the Ansul Dry-Eye System on one of your "problem" units. See if it doesn't make servicing easier, more profitable. Contact your local Ansul wholesaler for a supply of Dry-Eye Systems. ANSUL CHEMICAL COMPANY, Dept. D-62, Refrigeration Div., Marinette, Wisc.

ANSUL

tilled water easily and our site glasses are clear.

Prior to our investigation we had a couple of other machines score up for the third time. Our investigations led us to believe that the second and third scoring was probably attributable in many respects to improper honing of the rebored cylinders.—J.A.F.

Finned-Pipe Manufacturing

QUESTION NO. 1056: Large industrial finned pipe coil has involved me in several arguments as to how the fins are put on. I understand some are aluminum and are cast on, while others are steel and shrunk in place. Recently I learned that some of these fins are put on pipe by using oil pressure within the pipe. In other words, this party contended that some 4,000 pounds of oil pressure belled or ballooned the pipe to the shoulder of the fins. Do you know of this practice? If so, would it have any advantages? It seems to me that 4,000 pounds of pressure would tend to weaken the pipe wall and raise some doubt in my mind as to the longevity of the pipe. —A.D., Chicago.

ANSWER: Several companies have employed the process of bonding fins to pipe by means of high internal pressures. If my memory serves me correctly, the process is accomplished using nitrogen at 3000 psi as the working medium. In any event, finned coils made in this manner have been used successfully in a number of installations. The principal advantage claimed for this type of coil is the close bond of the fin to the pipe. It is claimed that this close bond assures better heat transfer from pipe wall to fin. There is no particular damage to the pipe wall nor shortening of pipe life.

You may be interested in a new development of a similar process which may prove to be one of the most revolutionary in many years. A worker paints "stop weld" on a flat piece of metal. Two pieces of the metal are heated and rolled under extremely high pressure until they are bonded together. However, the "stop weld" prevents bonding at all areas on which it has been applied. Liquid is then forced into the non-bonded areas under heavy pressure and a pattern of tubes is formed within the metal itself. This process has already been used to build evaporator plates for over 250,000 refrigerators.—H. P. Hayes.

Wants Bread Freezing Data

QUESTION NO. 1057: Would it be too much trouble for you to give me some particulars on the freezing and thawing of bread? The information I would like is the temperature of the bread entering and leaving the freezer, time in the freezer, the temperature of air, and in the thawing side — the method used, temperature and time taken. Is any special product formula required?—R.F. Glasgow, Scotland.

ANSWER No. 1: The data I have available on the freezing of bread are somewhat limited. However, several definite statements can be made:

1. Proper freezing of bread will satisfactorily retard staling.

2. At the freezing point, bread becomes stale faster than at room temperature. However, at minus 10 F the "freshness" can be maintained for about 20 days. At minus 30 F, bread has remained fresh for as long as 90 days.

3. A large scale eating test showed that month old bread frozen at minus 10 F rated almost as high as fresh bread.

The above remarks refer to freezing of the bread after it has been baked. As you probably know, yeast in frozen dough loses its activity in from one to three weeks.

You may wish to write for reprints of articles which appeared in the "Baking Industry Magazine" April 24, 1954 and March 13, 1954. They contain some additional details of interest and may be obtained from the Clissold Publishing Co., 105 West Adams, Chicago, Illinois.—H. P. Hayes.

ANSWER No. 2: The Refrigeration Research Foundation reported studies underway at Western Utilization Research Branch, U. S. Dept. of Agriculture, Albany, Calif. by Dr. Jas. W. Pence. Dr. Pence, a chemist, heading up Wheat Unit, Field Crop Utilization Section, commented as follows: "Progress of the freezing studies now under way at the Albany laboratory was reported at the Chicago meeting of the American Society of Bakery Engineers, March 7-10. A complete report will be published in the Society's Proceedings in July.

"A more detailed paper describing the effects of temperature and air velocity on freezing rates of bread has been accepted for publication in Food Technology, and is scheduled to appear in the July issue. A third paper describing effects of storage conditions on quality retention in frozen bread will be presented before the national meeting of the Institute of Food Technologists in June. Again, however, I have no available copy of the first manuscript and the second is unfinished. In the meantime, I would be happy to answer as best I can any particular questions about bread freezing on which we may have information."

Ruth Lee Harrington, special writer, Bakers Weekly magazine, reviewed Dr. Pence's first paper in that publication's Feb. 28, 1955 issue, apparently from an advance release of the doctor's report. Tear sheets of that review are available. It is interesting to note that the Bakers Weekly has an experimental bakery laboratory. Tests conducted in their facilities have recently been published. "Modern Methods for Freezing Baked Products" contains, in addition to the tests, case histories of bakeries now using freezing processes. Their publication is available at $2.00 per copy.—JRK.

Asks Coloring For Water Ice to Detect Subsidized Competition

QUESTION NO. 1058: Currently, we are producing ice for sale to the general public as well as the fishing industry. However, through Government Regulations, we supply the fishing industry with ice at half the cost of which it is sold to the general public. This is done with the object of assisting the fishermen by keeping the cost of ice sold to them at the lowest possible figure.

The ice that is produced for sale to fishermen is frosted, while ice that we sell to the general public is clear. We have observed that the frosted ice which is sold to the fishermen, and which we expect only to be used in the fishing industry, is being sold to the general public by these same fishermen.

We find it difficult to know exactly how much ice a fisherman really utilizes, and as a result of this, he has the opportunity to over purchase and is able to sell at competitive price with us to the general public. We should like to color the ice which is presently being sold to the fishermen, and would ask your advice on this matter.—J.M.F., Georgetown, British Guiana.

ANSWER No. 1: Your question is one to which I hope our membership-at-large will respond generously. I am reluctant to make any recommendation as to a coloring substance you might use for your ice. In the United States we have been conditioned over a period of years to look upon ice much the same as we would any foodstuff, in as far as sanitation and health codes are concerned. Actually in some areas the general sanitary conditions under which ice is made must by law comply with typical health codes for food and drink. If I were faced with your problem in California I would consult with medical officials before taking any steps at all.

With respect to your problem, there are two points that should be made:

1. If the coloring used is completely harmless, the potential consumers of such ice would soon realize this fact and continue to use it anyway. Ultimately it might take legislation to prohibit the resale of this ice. Such legislation could be written in such a manner that block ice would have to be clear in order to be legally saleable. With this thought in mind, it might be wise to sound out the prospect of legislation immediately rather than attempt to color the ice. This seems reasonable since it was legislation which initially created your present difficult position.

2. If the coloring used is such as to be harmful or offensive to humans, you would probably be forced to clear with health officials before taking any definite action. Perhaps some of our readers have encountered such a problem as yours and can offer some helpful suggestions.—H.P. Hayes

ANSWER No. 2: Supplementing Dean Harold P. Hayes' answer, we might point out that there have been many attempts to color ice. An extensive report on coloring of ice and the uses of germicidal ice was reported on in Ice and Refrigeration, April 1947, by the late Emerson Brandt. This article cited numerous reports by various government regulatory bodies, all of which discouraged the use of coloring or chemicals—JRK.

New Questions

Pipe Identification Colors

QUESTION NO. 1059: What is the generally accepted color code for painting pipe lines in the engine room? We would like to paint the following: water, liquid ammonia, ammonia suction, ammonia discharge, ammonia Valves, and ammonia pump-out lines. If there is any particular code that is applicable, we would appreciate your listing of these colors.—J.B.E., Denver.

Clear Ice From Well Water Without Distilling Costs

QUESTION NO. 1060. We are running an ice factory with a steam plant. We recently had an analysis made of our well water and received the following results:

Total Solids — 625 ppm
Acid Radicals:
Bicarbonate — 280 ppm
Carbonate — 90 ppm
Chlorides — 93 ppm
Sulphates — 95 ppm

The ice manufactured from this well water is opaque and does not sell well in the market. Hence we manufacture ice after distillation of water. This is costly and does not meet competition.

Will you be good enough to advise how we can manufacture transparent ice from this well water without resorting to distillation?—T. S. Punjab.

Seeks Mobile Defrost System

QUESTION NO. 1061. I manage a cold storage plant with Calcium Chloride Brine System refrigerated by two ammonia compressors 7½ in x 7½ in and 5½ in x 5½ in. I want to find the best method for defrosting the coils in the room.

In Calcium Chloride in Refrigeration," by Solvay Technical and Engineering Service, Bulletin No. 4, Sixty-th Edition, Issued 1953, page 33, I see in paragraph 3 a periodic defrosting by a portable tank unit complete with electric heater. That system would be convenient for my purposes. Have you any information on the subject? Are those portable tanks manufactured? Any plant you know equipped with a portable tank?—G. B. Rimouski, P. Q.

Queries Detrimental Effect Commercial NH_3 Impurities

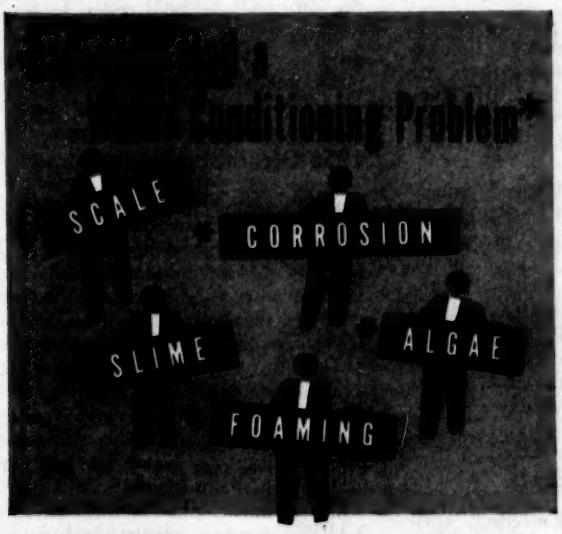
QUESTION NO. 1052: Concerning R.T.'s answer to (Question No. 1047) in the April issue "Industrial Refrigeration", R.E. explains that commercial grade liquid ammonia is 99.50 percent pure while refrigeration grade lacks .002 percent of being pure. I am wondering just what these impurities in the commercial grade would consist of. Would they be of an explosive or perhaps corrosive nature, or would it be in the form of moisture?

We are of the opinion that such a small amount of impurities would be of no consequence at all especially where close attention is given to purging.

It so happens that we have almost an endless supply of the commercial grade of ammonia at our back door, and at a price of less than half what we are paying for the refrigeration grade. We are quite anxious to take advantage of this cost situation, as well as the convenience of delivery if such a thing is possible. I shall greatly appreciate any information that it is possible to get concerning the above.—B. E. S., Fairmont, Minn.

Does Energy of Compression Dissipate in Cooling Water

QUESTION NO. 1063. If you had a water cooled air compressor which was operated slowly enough to compress the air without raising its temperature, where would all the energy of compression go? If I understand the fundamentals correctly, the energy content of air doesn't change unless the temperature changes. As I see it, you haven't added any energy to the air so all the horsepower input just heats up the cooling water. So if you end up with 100 psi compressed air that doesn't have any more energy than when you started, what have you accomplished?—J. H., Santa Clara, Cal.



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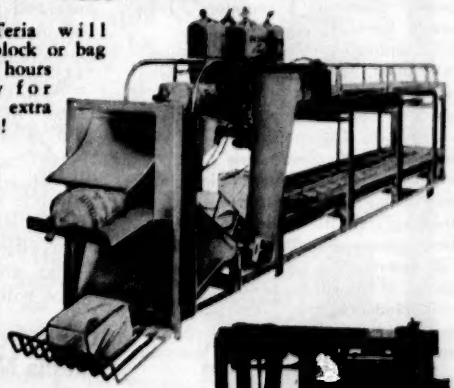

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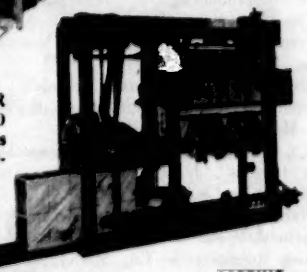

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ASRE Semi-Annual Meeting at Milwaukee

SOME of the country's foremost refrigeration and air conditioning engineers will address the 42nd semi-annual meeting of the American Society of Refrigerating Engineers in Milwaukee, Wisconsin, June12 to 15, at the Hotel Schroeder. In addition to three technical sessions, the diversified technical program will include an air conditioning conference, a domestic refrigerator engineering conference and six forums. Program Committee Chairman, E. P. Palmatier, Carrier Corp., has announced the following program of papers to be presented:

"The Injection Refrigeration Cycle", Willis Merle Carter, Phd., Professor of Machine Design, University of Kentucky.

"Characteristics and Performance of Rotary Compressors", H. F. Lehmkuhl, Seeger Refrigerator Co.

"Moisture Migration in Hermetic Refrigeration Systems as Measured Under Varied Conditions", W. R. Brisken, Manager Advanced Engineering, G.E. Co.

"Physiological Effects of Environment of Domestic Animals", H. L. Garver, Agricultural Research Center, Department of Agriculture.

"Insulation in Refrigerated Transportation Body Design", S. W. Eby and R. L. Collister, Armstrong Cork Co.

"Moisture Problems in Low Temperature Railroad Transportation", T. M. Elfving, President, Isoflex Corp.

"Rate of Solidification", D. L. Cochran, Stanford University.

"Brazing Aluminum Evaporators", John Blomquist, Reynolds Metals Co.

"Roll Bonding Aluminum Evaporators", Mason Randel, Western Brass Div., Olin Mathieson Corp.

"Connectors for Aluminum Evaportors", E. G. Beck, Jr., The Stolle Corp.

"Corrosion and Electrolysis", R. L. Hadley, Eng. Mgr., Metallurgical and Ceramics Lab., General Electric Co.

"Finishing", R. B. Vanden Berg, Process Development Lab., Aluminum Company of America.

"Rating of Cooling Towers", W. J. Donovan, Moderator.

"Designation of Refrigerants", A. H. Lawrence, Jr., E. I. DuPont de Nemours & Co., Moderator.

"Distribution of Frozen Foods", O. Kirkpatrick, Union Asbestos & Rubber Co., Moderator.

"Emergency Refrigeration During Disaster Periods", J. H. Spence, Hussmann Refrigeration Co., Moderator.

"Natural Convection Condensers of Self-Contained Products", F. G. Peck, C. E. Ranney Refrigeration Co., Moderator.

"Corrosion Preventing Finishes", R. A. Line, Hussmann Refrigeration Co., Moderator.

"New Thermodynamic Properties of Freon-12", R. C. McHarness, Research Supervisor and Dr. B. J. Eiseman, Jr., Research Chemist, E. I. DuPont de Nemours & Co., Inc., and Prof. J. J. Martin, University of Michigan.

"Vibration and Vibration Analysis of Commercial Units", C. A. Hathaway, Chief Engineer and K. A. Merz, Engineer in Charge, Products Development, Torrington Mfg. Co.

"Some Practical Aspects of the Dielectric Properties of Refrigerants", E. A. Beacham and R. T. Divers, Central Engineering Staff, Materials Standards Dept., Carrier Corp.

"Builders View Point of Austin Village", N. A. Cole, Architect-Builder and President, Fabricon Co., Austin, Texas.

"Some of the Interesting Test Results of Austin Village", C. W. Nessell, Minneapolis-Honeywell.

"Field Application Suggestions from Austin Village", D. V. Petrone, President, Typhoon Air Conditioning Co., Inc.

"Notes on Equipment Design from Austin Village', I. P. Sharpe, Manager, Product Planning, Home Heating and Cooling Dept., General Electric Co.

Entertainment

The Host Committee, under the chairmanship of J. B. Kupfer, will go all out to give the members and guests a taste of Milwaukee gemuetlichkeit, see "The Braves" in action and enjoy Milwaukee's natural hospitality.

The annual ASRE golf tournament will be held at Tuckaway Country Club. On Sunday evening there will be Open House for the ASRE Members and guests. A Polish Panorama will be featured by the Mazur Polish Dancers of Milwaukee.

Monday noon, the Welcome Luncheon will be addressed by Paul Pratt, Assistant to the President of the Borden Co., — subject, "The Food Industry." Prominent leaders of the industry will be presented and the new ASRE Regional Directors and other officers will be introduced.

The cocktail party and dinner dance will be held Tuesday evening.

Chicago Section ASRE Elects New Officers

AT THEIR annual meeting, April 14, Chicago Section, ASRE, elected officers for the 1955-56 term. E. J. Robertson, Wilson & Co., is the new Chairman; E. C. Ward, United Cork Co, and J. R Kelahan, INDUSTRIAL REFRIGERATION, Vice-Chairmen; M. B. Goddard, Carrier Corp., Secretary and E. N. Johnson, Swift & Co, Treasurer. The Section held its annual Beer 'n' Skittles on May 6, and scheduled its annual golf tournament for June 23 winding up the 1954-55 season.

Regional Ice Conferences

THE series of regional conferences sponsored by The National Association of Ice Industries was continued during May with meetings at the Sherman Hotel, Chicago, May 10; at the Sheraton Hotel, St. Louis, May 12; at the Hotel Peabody, Memphis, Tenn., May 17; at the Hotel Texas, Fort Worth, May 20; at the Gunter Hotel, San Antonio May 24; at the Jung Hotel, New Orleans, La., May 26; at the Battle House, Mobile, Ala., May 27; and at the Hotel Roosevelt, Jacksonville, Fla., May 31. At each conference a full day was devoted to the general round-table discussion. All of the discussions dealt with topics of local interest and local significance.

Those discussions were augmented by photo slides made in ice plants, dealing with ice manufacturing and merchandising problems. They showed how icemen are changing their processing operations, how they are saving money, how they are cutting costs and how they are saving labor, and how they are going after new markets for ice.

At the Chicago meeting, George Steers Jr. presiding, the following subjects were covered: delivering processed ice, vending ice, cabinets for selling ice in retail stores, hydrocooling, truck icing, sanitation and good housekeeping, poultry icing, and punch bowls.

Refrigerated Warehouse 1955 Directory Issued

THE 1955 Directory of Public Refrigerated Warehouses is available at no charge to firms using the facilities of refrigerated warehouse for the storage of perishable commodities, the National Association of Refrigerated Warehouses announces.

The Directory, which is published annually by NARW as a service to its members and the perishable foods industry is a comprehensive guide to public refrigerated warehouse space; local, national and international.

It contains detailed listings of all NARW member plants, including storage space capacity (freezer and cooler), personnel, railroad lines, insurance rates, investment figures and special services rendered by the individual plants. Included also are detailed listings of NARW Associate Members, well known suppliers to the perishable foods indusrty.

All requests should be addressed to the National Association of Refrigerated Warehouses, 608 Tower Building, Washington 5, D. C.

Sanitation Code For Poultry

A NEW "Poultry Ordinance" (Sanitation), commonly known as the Uniform Sanitation Code, has been released by the U.S. Department of Health, Education and Welfare. The ordinance is offered as a model for States, municipalities, counties, or health districts enacting such regulations, subject to the approval of the appropriate legal authority.

Announcement of the release of the ordinance came from Dr. Cliff D. Carpenter, president of the Institute of American Poultry Industries, following a meeting of the Poultry Industry-Public Health Liaison in Chicago recently. "Early in 1952", said Dr. Carpenter, "some jurisdictions were in the process of preparing health regulations governing poultry processing plants. Officials realized that many of them were not fully informed or familiar with the rapid changes that had taken place recently in the poultry industry. They, therefore, felt there was a definite need for assistance. Many were willing to wait until a uniform code could be drawn up rather than numerous groups preparing separate and conflicting regulations and codes—which would only cause confusion, set up trade barriers, needlessly handicap the industry, and increase the cost of poultry to the consummer. The Institute accordingly met with public health to discuss ways and means of providing the public with the best possible poultry without establishing unworkable ordinances."

Out of this meeting, the Poultry Industry-Public Health Liaison was formed. The committee, composed of seven industry representatives from the Institute of American Poultry Industries and seven representatives of the public health service have been at work on the problem for almost three years. Subject to the review of the Liaison, Public Health has now prepared the basic code or ordinance just released covering poultry processing sanitation.

The requirements under the Uniform Code are substantially the same as the Sanitation Requirements already in effect in plants operating under the Poultry and Poultry Products Inspection Program.

Tests of Insulated Structures

STUDIES, under conditions in a refrigerated warehouse, of the behavior of a wood substance (Redwood bark fiber) within insulated construction inside a vapor barrier have been reported by Edward Simons, consulting engineer, San Francisco and past president of ASRE. The study was extended to include reflective aluminum-sheet insulation and wood separator strips. In earlier studies, this author obtained data on Redwood bark fiber as an insulant and on its performance in actual wall tests, with and without addition of flameproofing.

Convection was found to be negligible. Moisture content of wood within a properly installed vapor barrier is quite low at the barrier. Moisture content of all wood within the barrier is considerably less than the saturation content of wood. Air conditioning and psychrometric effects in insulated fill construction and reflective insulation construction maintain wood in conditions which do not favor decay under steady operating conditions. Where fluctuating or off-service conditions exist, saturation may occur and naturally durable wood such as cypress or redwood should be used at critical points. Redwood bark fiber is naturally decay resistant. Treated wood should not be used with aluminum reflective sheets. — TRRF Bulletin.

HOWE COMPRESSOR INSTALLATION showing 4 models G-20-6½", 2 models GB-20-6½" Boosters, and 1 model G-15-5½".

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Innovations in Apple Handling Methods and Equipment

A MATERIALS handling research project on handling apples has been concluded in Washington by the Washington State Apple Commission's Research Department under a contract with the United States Department of Agriculture. Two objectives were (1) to develop and test improved methods for using present equipment; and (2) to introduce some of the newer types of materials-handling equipment, develop methods for the use of this equipment, and test the methods under actual operating conditions.

The program included testing eight innovations, five of which applied to the receiving of apples; one to shipping; one to reducing costs of pallets; and one to moving fruit between levels. These eight innovations, which are reported in full in a 90 page bulletin, and the major findings in the test were:

Gravity-type roller conveyors were installed at a belt-conveyor plant on warehouse platforms and road-truck beds for receiving 36-box unit loads on pallets. Unloading by this new method cost about the same as unloading boxes one at a time, but added costs incurred at the orchard, inherent in the new method, made the innovation more expensive. The elapsed time for unloading 1,000 boxes, however, was reduced from 1.5 man-hours to 0.27 man-hour, and this saving in time for the road truck and its driver would have resulted in a reduction in total costs.

Truck Trailer Trains

Forklift truck-trailer trains were used for transporting apples from storage to the packing line. An industrial forklift truck was used to pull a train of three trailers carrying six 48-box pallets of apples for 300 feet to the dumping area in a new one-story plant. The forklift truck was used to load the pallets onto the trailers; when one train was used, it also unloaded them on roller conveyors at the dumping station, and when three trains were used, the trailers were released at the dumping station, and boxes were unloaded as needed. There was no saving in handling costs when one train was used, but when three trains were used the labor and equipment cost of handling 1,000 boxes was reduced from $5.66, when the forklift truck alone was used, to $3.74 by the new method.

Tractor-trailer trains were used for transporting apples between storage and the packing line. Three trains of three trailers each, towed by a tractor (mule) instead of an industrial forklift truck, moved unpacked fruit from storage to the packing line and moved packed fruit from the packing line to storage. One industrial forklift truck was used at the packing line and another in the storage room to load and unload boxes of apples. This method proved to be much more expensive than the usual method of using two forklift trucks, one at each end of the packing line, to perform the whole operation.

Clamp-Type Lift Trucks

Twenty-four-box industrial clamp-type lift trucks were used for handling apples in plants of more than one story and equipped with belt- conveyors, and customarily using hand trucks. Conveyors were continued in use for interfloor movement of apples. When the 24-box clamp truck was substituted for the usual hand truck and manual high-piling methods, costs per 1,000 boxes for receiving fruit into the plant were reduced from $12.60 to $9.38. Substantial savings were realized when a mechanical high-piler or an industrial clamp truck was used for high-piling boxes of apples and breaking them out of high piles. When the 24-box clamp truck, instead of the usual hand-truck and manual methods, was used to move the fruit from the packing line back to storage, costs were reduced from $20.79 per 1,000 boxes to $12.78.

Twelve-box industrial clamp-type trucks were used for moving apples from storage to the packing line and for loading refrigerator cars. This method showed little or no saving compared with the usual methods.

Broad-blade industrial forklift trucks were used for handling unpalletized unit loads. The saving from elimination of pallets by this method was more than offset by costs arising from the necessity for top tie frames and dunnage strips and a reduction in maneuverability of the equipment, so that the innovation resulted in higher costs than those of the used methods.

Forklift Truck on Each Floor

Industrial forklift trucks and elevators were used for moving pallet loads between floors in multi-story buildings. By using a forklift truck on each floor to move boxes of apples between floors, the cost of handling the apples was $1 per 1,000 boxes less than when using the trucks and an elevator. Also, it cost $1.36 less to move the fruit from storage to the packing line with the trucks alone, as compared with costs for the trucks plus an elevator.

Thirty-six-box pallet loads of apples were loaded into a refrigerator car at a packinghouse and unloaded as units at destination. Use of this pallet system proved to be more than twice as expensive as the commonly used methods. Most of the cost of the pallet system lay in the cost of expendable pallets and strapping material.

This report by Earl W. Carlsen, director of research; Raoull S. Duerden, industrial engineer; D. Lloyd Hunter, industrial engineer, Washington State Apple Commission; and Joseph F. Herrick, Jr. Agricultural economist, Transportation and facilities branch Marketing Research Division, Agricultural Marketing Service.

Frost Heaving Studies

AS A result of a preliminary survey among refrigerated warehouses, a dozen warehouses have been selected for detailed study of the factors involved in frost heaving. Warehousemen are cooperating fully in this endeavor to obtain useful data directly from warehouse sites. The study is underway at University of Minnesota under the direction of Dr. Miles S. Kersten. The project has other phases, including a thorough survey of published information, especially from foreign countries. Recently a study by Dr. Robert Ruckli, "Der Frost Im Baugrund" (an important work) has been translated. The Refrigeration Research Foundation has a copy of the original report, available for loaning to members.—TRRF Bulletin.

A & P Considers Own Label For Frozen Orange Juice

THE Great Atlantic and Pacific Tea Company, the nation's largest grocery chain, is considering marketing frozen concentrated orange juice under its own lable. Joseph M. Zoller, citrus purchasing agent for the company in Baltimore, said the A. & P. has been talking to packers of frozen concentrated juice. A spokesman for the company confirmed that frozen concentrate is one of several private label items being considered.

Frozen Foods in Homes

THIS definition is going around: "A good cook is a wife who serves a meal that she thawed and heated all by herself." Seriously, USDA home economists have made calculations that show that a homemaker who uses food in the "rough" form makes about 45 cents an hour for the extra time she spends on such work. She can make more working outside the home, and that is a reason for the fact that about a third of American married women have jobs outside their homes. Frozen prepared foods are moving into a wide-open market.

In Modern Hospital for March of last year, Florence Merriam listed reasons for frozen food procurement by hospitals. The same reasons apply elsewhere but the hospital procurer has probably considered them more seriously than most people do. Here they are: (1) Edible portion is known in advance and this is useful in portion control and unit costs; (2) out-of-season buying is possible with savings; (3) Preparation labor is minimal; (4) Versatility — usefulness in many recipes and (5) Excellence in nutritive values, color, flavor, etc.—TRRF Bulletin.

Bridging Railroad Track

THE PROBLEM of bridging a railroad track between two warehouses was solved by Nalley's, Inc., Nalley Valley, Tacoma, Wash., by inserting an automobile grease hoist between the tracks. The hoist raises the bridge into position and lowers it when the track is in use. It has folding corner posts for rigidity and carries fork-truck loads easily.-TRRF Bulletin.

Tax Amortization For New Refrigerator Cars

CERTIFICATES of necessity for accelerated tax amortization have been granted to the Fruit Growers Express Co., Washington, D.C. for new refrigerator cars amounting to $6,650,000; and to the Western Fruit Express Company, Washington, D.C., for new refrigerator cars amounting to $1,075,000.

Refrigerator Cars Ordered

AN order for 200 50-ton overhead-iced refrigerator cars has been placed with the National Steel Car Corporation by the Canadian National Railways.

Midwest Regional Conference

(Continued from page 43)

Midwest Regional committeemen responsible for this conference were Bert C. McKenna, Chairman, and W. L. Tiffin, Secretary, both of Chicago; C. W. Stoner, Milwaukee; Ken M. Holaday, St. Louis; Roy T. Burns, Detroit; Lester Winkler, Green Bay and B. E. Smith, Member-at-Large, representing Minnesota chapters. Conference Sub-Committees were headed up by the following Chicago members: Bob Kruppe, Joe Farrell, Alex J. Duffy, Hubert Rancour, Wm. V. Richards, Eugene Rytlewski, Earl J. McMichael, John M. Forti, Robt. K. Howe, Nicholas M. Downes, Jos P. Wimsatt, A. J. Kennedy, Jr. and Harold M. Michler. Mrs. Hubert Rancour headed the ladies committee. A. O. Clementson is President of the Chicago Chapter, and Wm. J. O'Reilly, Recording Secretary.

Small Business Loans

APPROVAL has been announced of 48 additional loans by the Small Business Administration, totaling $2,082,400, to assist small firms. These loans include the Talladega Ice & Storage Co. Talladega, Ala., and Norwood Ice Co., Northampton, Mass.

OHIO SPECIAL ICE CANS

WELDED – RIVETED

ICE CAN GRIDS

Industrial Trucks

and Trailers

THE OHIO GALVANIZING & MFG. CO.

NILES OHIO

8 ways Superior to other Freezing Units

1 King Systems provide greater cold-room capacity.

2 Faster Freezing, allowing faster product turnover.

3 Better air distribution, balanced refrigeration.

4 Cleaner, frost-free room.

5 King Systems permit adaptation of more simplified product handling methods.

6 Continuous operation—no defrosting shutdowns.

7 Operate with lower power consumption.

8 King Sharp Freeze Systems are engineered to your specific needs.

Architect-engineer consultant inquiries invited. More than 50 years experience is at your disposal.

THE King CO. OF OWATONNA

907 N. CEDAR ST. OWATONNA, MINNESOTA

Book Reviews

HEATING, VENTILATING AND AIR CONDITIONING GUIDE for 1955. Published annually by The American Society of Heating and Air-Conditioning Engineers. 1680 pages. Illustrated. Price $12.00. For sale by Nickerson & Collins Co., Chicago.

This 33rd edition contains the latest technical and equipment information, and is both larger and improved in content. The technical section is 1160 pages, and the equipment section includes technical data concerning the products of 328 manufacturers.

The many revisions and expansions are the result of research by the Society and others, changes in codes and standards, new methods in product design, and improved engineering practices. However, despite the many improvements, the appearance and arrangement of the chapters is the same, and the 53 chapters are grouped the same as last year. Also retained are the edge indexes in both the Technical and Catalog Data Sections, and classified subject and product indexes; and the 24 x 32 inch ASHAE psychrometric Chart is still included.

The many changes include several rewritten chapters, a new chapter on schoolhouse heating and ventilating, new information on heating systems using high temperature hot water, and reorganized design information on thermal conductivities and conductances for pipe insulation and building materials. In addition, there are major revisions and changes in many of the chapters.

AIR CONDITIONING REFRIGERATING DATA BOOK, Applications Volume published by American Society of Refrigerating Engineers. Illustrated. Price $7.50. For sale by Nickerson & Collins Co. Chicago, Ill.

This volume is one of a continuing series of data books published by the ASRE. It is the fifth edition of the Applications Volume, first published in 1940. It consists of 61 chapters. Those of the previous edition that had become obsolete or of little general interest were either rewritten or omitted to make room for new material. Chapters on precooling, fishing boats and passenger automobiles are entirely new additions. Others were entirely rewritten and most of the remaining chapters were revised to conform to current practices. It was the aim of the editorial staff to include more technical information of value to the industry and to this end the authors were requested to include more design information, formulaes, tables, diagrams, and sample engineering calculations. It is contemplated that this will be continued in future editions.

Los Angeles Grocer Chain Builds Own Storage Plant

(Continued from page 17)

Warehousing Operations

Ralphs' Frozen Foods warehouse was planned for maximum efficiency. All products in storage are palletized, and handled with electric fork lift trucks. Foods on long term storage are placed in the minus 10° F room and later transferred to the 0° F room for distribution. Short term products remain in the distribution room. The 0° F room serves as a lot or quantity breakup area for grouping shipments to individual stores. A loud speaker system was installed to expedite transfer orders, and to assist the warehouse superintendent in directing proper storage.

From management reports, it is very apparent that great quantities of products can be handled with a minimum of expense, with the assurance of a safe dependable operation entirely under control of the firm's own personnel.

Meat Packer Reports

(Continued from page 31)

rolled straight through to destination without switching and time delays caused by stops at reicing stations, we will have gained another major point in delivery of our product. From the quality standpoint, there is no substitute for the rapid consumption of product after manufacture. Mechanical refrigeration provides the best crutch to take care of this time that has to be used in getting the product from the factory to the customer.

Our studies are continuing, as our interests are toward increasing the number of cars in our service. The frozen foods people are calling for more cars from the car lines. At present there are 384 cars in regular or in test service, and more are being planned. This is a very small percentage of the 125,000 to 130,000 refrigerator cars in use in the country but we anticipate a rapid growth of these fleets.

Mountain States Convention And Regional Conference

FOLLOWING a one-day regional conference of the National Association of Ice Industries at the Brown Palace Hotel, Denver, Colo., April 22, the annual convention of the Mountain States Association of Ice Industries was held the day following, Saturday, April 23.

The regional conference concerned itself largely with merchandising problems in the ice industry, with particular attention to the new markets being opened.

The sessions of the Mountain States Convention were well attended and there were many lively discussions. There seemed to be no doubt in any one's mind that there is an opportunity for profit in the ice business. The discussions were centered largely on processing and sales methods and dollar rather than tonnage volume.

Those attending the convention were very much saddened by the serious illness of the Secretary, J. Reimer Espy, who has been a leading figure in Mountain States conventions for many years. Mr. Espy's later death came as a great shock to all.

Officers were elected as follows:

President, Robert L. Belcher, Pueblo, Colo.

Vice-president, Waldo Todd, Santa Fe, New Mexico.

Illinois Spring Meeting

THE spring meeting of the Illinois Association of Ice Industries held in Springfield, Friday, April 29, brought together a representative group of Illinois ice men.

Following adjournment an inspection of the low temperature storage facilities under construction at the plant of Central Illinois Ice plant proved very interesting. George Heath, general manager of the Ice Division, Oscar Mayer Packing Co. of Madison, Wisc., flew the company plane to Chicago where he picked up Director Herman Weindell of Lincoln Boyle Co. and together they flew to Springfield.

Northwest Ice Convention

THE Northwest Association of Ice Industries at the annual convention held in Portland elected W. L. Baker, manager of the Seattle Ice Company, president. William Wilson of Victoria, B. C., was elected vice-president and W. F. McCraken of Anacortes, secretary-treasurer.

Refrigerated Barge Keeps Fish Fresh

BARGES equipped with refrigeration units to preserve fish in sea water at a desired temperature will be used in the Seattle fishing industry. One of three barges is being built by Libby, McNeill & Libby. It has two tanks, each of which can hold 35 tons of fish.

A York refrigerating unit will hold the water and fish in the tanks at a temperature of 30 F. The water is chilled by a serpentine coil installed so that the fish do not come in contact with it.

"A 60-degree fish will be chilled to 30 degrees in 30 hours", said E. B. Genung, Jr., of the Refrigeration Engineering Co., which installed the refrigeration unit. "The temperature can be taken down from 60 degrees to 45 degrees in ten hours. Then 20 hours will be required to get it to 30 degrees, where it will be held."

By using refrigerated sea water, the barge can take on fish a longer distance from a cannery, K. K. Kent, district superintendent of the Libby company, explained. "It's very useful when you're having small bunches of fish," Kent said. "You don't have to go to the cannery every day."

While the new equipment doesn't have a name, it is described by Les Hooey, who is in charge of the installation for the Libby company, as "refrigerated sea-water fish-holding tanks."

British Columbia trollers have used refrigerated sea water in small tanks for the past two years. Refrigerated sea water also has been used on shrimp boats on the Gulf of Mexico and has been tried in a few canneries.

The barges being fitted out in Seattle, however, are said to be the first in the salmon industry to use refrigerated sea water for holding large amounts of fish at sea.

COMING CONVENTIONS

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS
June 12-15, 1955
Hotel Schroeder, Milwaukee, Wisconsin
R. C. Cross, Executive-Secretary

NATIONAL ASSOCIATION OF POWER ENGINEERS
June 13-17, 1955
Hotel Waldorf Astoria, New York
A. F. Thompson, National Secretary

CANADIAN WAREHOUSEMENS ASSOCIATION
June 20-23, 1955
Banff Springs Hotel, Banff, Canada
H. Cecil Rhodes, Executive Secretary

NATIONAL ASSOCIATION PRACTICAL REFRIGERATING ENGINEERS
November 8-10, 1955
Ambassador Hotel, Los Angeles, Calif.
J. Richard Kelahan, Secretary

NATIONAL ASSOCIATION OF ICE INDUSTRIES
November 15-18, 1955
Biltmore Hotel, Los Angeles, Calif.
Guy W. Jacobs, Exec-Secy.

AIR CONDITIONING and REFRIGERATION EXHIBIT
November 28 through December 1, 1955
Atlantic City Exhibition Hall, Atlantic City, N. J.

DELTA STATES ICE ASSOCIATION
December 4-6, 1955
Buena Vista Hotel, Biloxi, Miss.
Mrs. Edna Vaughan, Secretary

SAVE HALF THE ENGINEER'S TROUBLES WITH A REFRIGERATION PLANT

Hundreds of engineers have been interviewed about their experience with the Niagara Aeropass Condenser. In one way or another, they say, "I wouldn't go back to anything else." And their managers, who watch costs, say, "Best investment we ever made, couldn't operate now, without it."

Niagara Aeropass Condensers have three exclusive features which save trouble and money in running a refrigeration plant:

"The Duo-Pass"— keeps scale and salts from crusting the coils, keeps the condenser always at full capacity.

The "Oilout"— removes oil and dirt from the refrigerant, at the exact point where the oil vapor is condensed and the refrigerant is not.

The "Balanced-Wet-Bulb" control gives automatic operation at the minimum head pressure, saving power cost the year 'round!

In addition, the Niagara Aeropass Condenser saves nearly all your cost of cooling water, quickly bringing back to you the cost of installation. In plants where refrigeration is a production process, owners know that this condenser has reduced their costs.

Write for Bulletin 103; Address Dept. IR
You can see one of these installations near you.

NIAGARA BLOWER COMPANY
405 Lexington Ave. New York 17, N. Y.
District Engineers in Principal Cities of United States and Canada

DEATHS

James Reimer Espy

THE DEATH of J. Reimer Espy, prominent in the ice industry for many years, occurred at St. Lukes Hospital, Denver, Colo., April 27. He was 69. Mr. Espy was president of the Espy Ice Company, Denver and was secretary of the Mountain States Association of Ice Industries for 15 years. He also was a member of the Denver Chamber of Commerce for several years. He belonged to the Montview Presbyterian Church, Scottish Rite Masons, El Jebel Shrine and the Denver Athletic Club.

Mr. Espy came to Denver with his parents from Manmouth, Ill., when he was two years old. He attended the University of Colorado for two years and completed his education at the University of Denver, where he received a law degree. In 1909 he moved to Clayton, N. M., where he practiced law until 1911 when he returned to Denver and practiced law until 1913 when he joined his father in the Espy Ice Co. and thereafter devoted his full time to that business. A patron of the Denver Civic theater and a strong supporter of the Central City Opera Assn., he also was interested in Kappa Sigma fraternity and served it in an advisory capacity at D. U. for many years.

Survivors include his widow, a daughter, Mrs. Bernice Espy Hicks, and a son, J. Bruce Espy, all of Denver.

Ice Plant Owner Drowned

EVERETT SMITH, owner of the Public Ice Service Company, Anna, Ill., drowned April 20 in a freak accident at the firm's concrete-enclosed water reservoir. Sheriff Roy Dillow of Union County said Smith, 55, apparently fell through a three-foot opening in the concrete roof to the water seven feet below and then clung to a pipe for some time before losing his grasp. His shouts for help could easily have gone unheard, authorities said.

FRED A. SHIPPEE, North Providence, R. I., manager of The Rhode Island Ice Company for 53 years died April 15 after a short illness. He was 76. Mr. Shippee was active in politics in North Providence for many years and was chief of police in that town in 1909.

Henry Adams

THE death of Henry Adams, Fort Mitchell, Ky., retired senior vice-president of the City Products Corp., occurred March 8 at St. Elizabeth Hospital, Covington. He was 70. Mr. Adams had lived all his life in Kenton County. In 1925 he joined the City Ice & Fuel Co. as Cincinnati manager, remaining through its change to The City Products Corp., and becoming a director, member of the executive committee and vice-president. During World War II he acted as head of the company's operations in the southeastern

GEORGE W. WARNER, manager of the Atlantic Company ice plant in Lake Wales, Fla., was stricken and died immediately of a heart attack March 4, at the plant. He was 54. Mr. Warner had been with the Atlantic Ice Company for several years.

News of People

HAROLD G. HACKE, assistant to the president of the Union Ice Company, San Francisco, Calif. was re-elected president of the Frozen Food Distributors of California at a late April meeting.

NEW

LOW COST ICE CRUSHER

All-Steel Crusher For 25 Lb. Block Ice Crusher

. . . Ideal for Ice Stations —Vendors and Small Stores . . .

Grinds 25 lb. block in 25 seconds with grate closed.

Four grate adjustments give crushed ice from "pea-size" to 1½" chunks, by merely turning grate handle on side of hopper.

Galvanized for prevention of rust.

All-steel shell, legs and grate handle.

Belt driven, no gears, and self-aligning ball bearings.

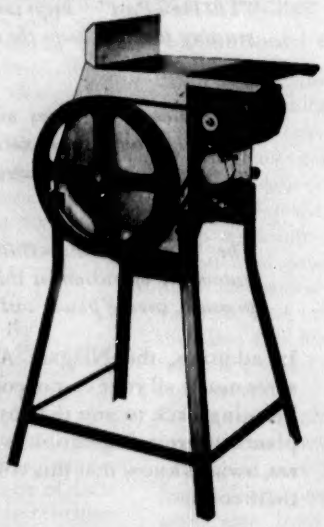
Chute for filling containers.

Safety-shelf for block ice to be placed before entering crusher.

Guard covers flywheel, belt and motor pulley.

Only $125.00 with 1/3 HP motor.

Bateman 25 CROWN ICE CRUSHER



Write For Full Information

Bateman Ice Processing Equipment

MINERAL WELLS, TEXAS

BOWER BB BRAND AMMONIA

Anhydrous Ammonia

Cupric Chloride

Ammonium Bicarbonate

Anhydrous Calcium Chloride, purified

Please keep empty cylinders rotating.

Est. 1858

HENRY BOWER CHEMICAL MANUFACTURING COMPANY

29TH AND GRAY'S FERRY ROAD

PHILADELPHIA 46, PA.

MANUFACTURERS' NEWS

Owens Corning Shows Product Line at Chicago Meeting

M. G. Jensen of the Fiberglas technical services in Chicago, J. L. Deppen and W. J. Deppen, both of the Cork Insulating Company of Chicago, J. P. Wimsatt of Owens-Corning's Chicago office and R. J. Deppen, also of the Cork Insulating Company.

MORE than 3,000 representatives of business, press and radio viewed the complete product line of Owens-Corning Fiberglas Corporation and heard the company's 1955 merchandising and advertising plans outlined recently at a meeting held in Chicago's Sheraton-Blackstone Hotel. This group paid particular attention to Owens-Corning's cold storage insulation exhibits.

Thermo King Aids Truck Safety Campaign

THE American Trucking Association has announced affiliation with the Foundation of the U. S. Thermo Control Company, Minneapolis, Minn., one of the world's large manufacturers of transport refrigeration. Foundation support by the makers of Thermo King will be in the form of a $15,000 fund to be used in an advertising program promoting highway safety in the trucking industry.

In making the announcement, Walter F. Carey, chairman of the American Trucking Foundation pointed out that the Thermo King organization is the first of many special equipment and parts and accessory companies who have Foundation membership under discussion to complete its affiliation with the trucking industry educational and research organization. M. B. Green, vice-president of U. S. Thermo, in outlining the company's project through the Foundation said, "The objective of our safety campaign is to save lives, save time and save money for the trucking industry by helping reduce costly accidents. Despite the remarkable showing of truck transport in the safety field, we share the opinion of the industry leaders that even one accident is too many and we want to make our special contribution to the industry and to the public by joining the operating industry to effect even greater improvement in safety performance.

This is NO Perfume Ad

but we can sweeten your air and save you money!

Chances are, when your refrigerating system is being purged, you can smell refrigerant gas. That smell indicates:

1. You are losing valuable refrigerant gas.
2. You are not getting efficient purging of all the air in the system.
3. You are wasting power.

With an Armstrong Purger, one ice cream manufacturer reported head pressures reduced 40 lbs. and power costs cut 20%. Another saved $255 in ammonia the first year. Still another saves $500 in ammonia annually.

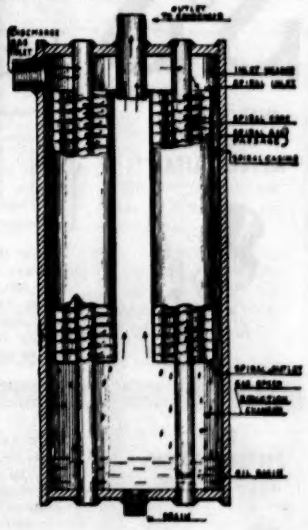
It's really worth looking into. *Send for Bulletin No. 221.*

ARMSTRONG MACHINE WORKS

860 Maple Street, Three Rivers, Michigan

"King Zeero"

OIL SEPARATOR



STOPS OIL FROM ENTERING CONDENSER RECEIVER AND LOW SIDE

Allows operation as was originally intended. Simple in operation — no parts to wear out — no screens, metal wool or any close screens to clog, raise discharge pressures and cut down capacity.

When used in connection with air compressors, water is also separated with the oil.

Made in 12 sizes, ½" to 6".

Built for years of trouble free service. Mechanical details on request.

THE KING ZEERO COMPANY

4300 14 W Montrose Ave. Chicago 41, Ill

Worthington Appointment

THE appointment of Henri Soumerai as assistant chief engineer of the Refrigeration Compressor Department at the Holyoke Works of Worthington Corporation, is announced by S. R. Hirsch, executive engineer.

Henri Soumerai

Mr. Soumerai will continue in the responsibility for design and development of hermetically-sealed compressors, low temperature refrigeration systems and water-cooled refrigeration condensers. He is a member of the American Society of Refrigeration Engineers, American Society of Heating and Air Conditioning Engineers and the Engineering Society of Western Massachusetts.

CATALOGS AND BULLETINS

Bulletin Describes Marlo Spray Dehumidifier

DETAILED information on the new Marlo line of Coil-Type Spray Dehumidifiers is contained in an eight-page bulletin now available from Marlo Coil Co., St. Louis, Mo. The new dehumidifier units, designated as Model SD, are available in 327 sizes, with air volumes from 600 to 76,000 CFM, and in custom models built to specifications for special applications. They perform complete washing, cleaning, humidifying, dehumidifying, heating and cooling functions. Included in the bulletin are complete data on all components, performance characteristics of the units, schematic drawings of standard arrangements, and instructions for ordering or specifying.

Maintenance of Brines with Calcium Chloride

OPERATING conditions of a refrigerating plant can often be improved by regular checks of brine and prompt corrections. Brief RB-1 "Maintenance of Calcium Chloride Brine" issued by Calcium Chloride Institute gives suggestions for accurately testing brine strength and tips for strengthening brine. It includes data on tests for ammonia leakage, alkalinity or acidity of brine, corrosion inhibitors, and methods for correcting acidity and alkalinity. A handy chart indicates proper amounts of calcium chloride needed in preparing or strengthening brine.

Hydraulic Institute Manual

THE Hydraulic Institute has announced publication of a "Pipe Friction Manual". Material in this Manual is an extension and rearrangement of the pipe friction data contained in an earlier publication, "Tentative Standards of the Hydraulic Institute — Pipe Friction".

Featured is a section demonstrating the mathematical calculations used in the construction of charts, supplemented by complete tables of friction loss for water in feet, per 100 feet of pipe. Wrought iron, steel and cast iron pipe sizes from ⅛ inch nominal to 84 inch I.D., are covered. Given also, are tables of resistance coefficients for valves and fittings, including the latest available data furnished in more detail than has heretofore been published.

S&S Announces! NEW 1955 Models

INTRODUCING THE NEW "METROPOLITAN"

Standard 8 ft. width but special 10 ft. length! Will accommodate up to eight 10-lb. bag vending belts or 4 10-lb. and 4 25-lb. belts. One coin switch will operate up to 4 belts delivering to a common delivery chute. Complete with automatic hot-gas defrost. Freight saving—4 per rail car. New smaller size ideal for high value locations. Made for high return party-ice bag vending. Unique high capacity tandem vending belt system reduces delivery and replenishing costs.

NEW REFRIGERATION PLUG SYSTEM

New automatic hot gas defrost system unit. Heavy duty G. E. refrigeration motors specially designed for maintaining low temperatures under severe heat conditions. Plug design units for utmost adaptability.

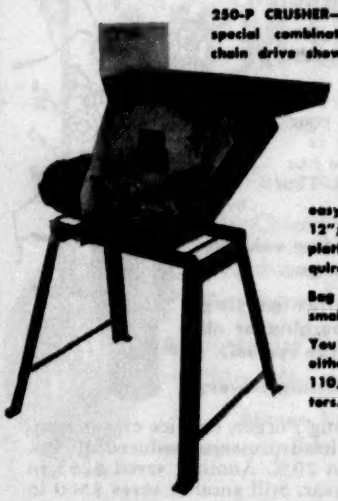
Contact the S & S distributor in your area.

Write for New S & S Refrigeration Manual—Free!

S & S VENDING MACHINE CO.
670 Lincoln Avenue San Jose, Calif.

ESKIMO Ice Crushers

The Finest, Most Economical Crusher Built Today — With Real Low Snow Content.



250-P CRUSHER—This unit is driven by a special combination of Two V-Belts and chain drive shown in the inset picture by a ¾ HP motor. Made from heavy steel plate, heavily zinc coated, self aligning ball bearings. The 50 lb. hopper opening is 12" x 13½" and also has a platform for easy loading. Drum size, 8" x 12"; height to the loading platform 47"; floor space required 31" x 32½".

Bag loading chute available at small additional cost.

You may get this motor in either 1 phase or 3 phase, 110/220 or 220/440 volt motors.

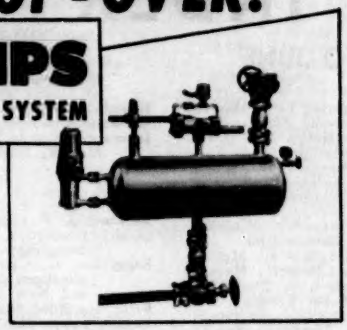
WRITE FOR CATALOG

BALLARD SALES COMPANY

COMPLETE SUPPLIERS TO THE ICE INDUSTRY

NO SLOP-OVER!

PHILLIPS
LIQUID RETURN SYSTEM



- **SAFEGUARDS** Compressors
- **ASSURES** Economical Operation with Full-flooded Coils

Here's the proved method of protecting ammonia compressors from the damages of liquid slop-over. Phillips Liquid Return Systems effectively return refrigerant liquid from a suction line trap to the liquid receiver or liquid line—and, effect savings in operation. With a Phillips System, full flooding of coils is possible for maximum efficiency of evaporation and properly-conditioned suction gases are assured.

PHILLIPS FLOAT CONTROLS
For "Freon"—
1 to 1000 Ton Cap
For Ammonia—
1 to 2000 Ton Cap

Several types of systems are available: for Gravity, Injection Lift and Pressure Lift operation, in sizes up to 1000 tons. A Phillips Engineer will gladly help to select the right one to assure complete protection for you. Write today for full information in Bulletin LRS-50.

H. A. PHILLIPS & CO. DESIGNERS AND ENGINEERS REFRIGERATION CONTROLS SYSTEMS
3255 W. CARROLL AVENUE • CHICAGO 24, ILLINOIS
REPRESENTATIVES: THE C & S EQUIPMENT CO.
2103 S. San Pedro Street, Los Angeles, California
MASON EMANUELS CO. • 1000 Fourth Ave., South, Seattle 4, Wash.

THE ONLY AIR-COOLED CONDENSER WITH THESE 2 ESSENTIAL FEATURES

REMPE
"Atmos-Therm"

1. **DESUPERHEAT SECTION** Special large volume gas inlet section. Hot gas from compressor expands slightly to accelerate its transfer from a dry gas to a wet vapor. Completion of change is made in smaller tubes.

THE REMPE "ATMOS-THERM"

- Completely eliminates the need for condenser water.
- Minimizes operating and service expense.
- Eliminates water supply and disposal cost.
- Is adaptable to inside or outdoor installation.
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VOLUME INDEX

VOL. 128 **JANUARY TO JUNE** **1955**

A

Air Condition Streets at Canadian Center Jan-17
Conditioning Improves Temperatures For Metal Parts Plant (illus) Jun-25
Cooled Condensers Cut Down on Costs of Maintaining Cooling Towers (illus) Jan-24
For Large Tonnages (illus) **Otto J. Nussbaum** Mar-15
American Standards Listed Apr-59
Warehousemen's Assn. Annual Convention May-13
Ammonia, How Dangerous Is (illus) **K. M. Holaday** Feb-31
Armour Pharmaceutical Center Refrigeration Plant (Illus) **W. F. Stoecker** Apr-15
Ashenbrenner, L. M., Modernizing the Older-Multi-Story Warehouse .Jun-23
ASHVE Approves Change of Name to ASHAE Mar-58
ASRE Semi Annual Meet Milwaukee Jun-25

B

Baker, C. T., Business Side of Engineering Jan-31
Barnard, W. R., Selecting and Using Freon Refrigerant (illus) ...May-43
Bergstrom, Earl E., Refrigeration in the Dairy Industry (illus) ..May-32
Book Review:
Air Conditioning Refrigerating Data Book Jun-56
Heating-Ventilating and Air Conditioning Guide Jun-56
Magnetic Control Industrial Motors .Apr-52
Boom in Ice, Increasing Vending Sales **O. E. Reardon** Feb-26
Brown, K. V., Los Angeles Grocer Chain Builds Own Frozen Foods Storage Plant (illus) ...Jun-15
Bureau of Standards Low Temperature Research Apr-32
Business Side of Engineering, **C. T. Baker** Jan-31

C

Calumet Industrial District Refrigerated Warehouse Center Feb-24
Canadian Ice Association Mid-Winter Conference Apr-53
Carlson Joins City Products Jan-50
Carroll, Thomas G., Cutting The Costs of Processing Ice (illus) Apr-26
Catalogs and Bulletins:
Acme Industries Inc., Catalog on Acme Dry-Ex Liquid Chiller .Mar-62
Refrigeration Components Shown in New Catalog Mar-63
Allin Mfg. Co., Catalog (illus) Mar-62
Alpha Plastics Inc., Plastic Pipe and Fittings Catalog Mar-63
A-P Controls Corp., Automatic Expansion Valve Catalog May-73
Bell & Gossett Co., B & G Catalog Mar-61
Design Manual For Cooling Tower Pumps Apr-62
Calcium Chloride Institute, Maintenance of Brines with Calcium Chloride Jun-60
Crane Co., Choosing Right Valve ..Mar-63
Dravo Corp., Crane Cab Air Conditioned Mar-62
E. I. DuPont de Nemours Co., Corrosion-Resistant Primer For Room Air Conditioners Jan-54
Air Conditioning Guide Jun-60
Eutectic Welding Alloys Corp., Welding Problems Jan-54
Fluor Corp., Cooling Water Mar-63
Gray Tool Co., Catalog on Graloc Pipe Connections Apr-62
Halstead & Mitchell, Bulletin Describes Sea Water Condenser .Mar-63
Henry Vogt Machine Co., Bulletin .Apr-62
Knickerbocker Stamping Co., Bulletin on Can Fillers Jun-60
Lewis-Shepard Products Inc. Gas vs. Electric Fork Trucks Apr-62
Marlo Coil Co., Bulletin on Marlo Spray Dehumidifier Jun-60
Polymer Corp., Bulletin on Flexible Nylon Pressure Tubing ...May-73
Rowe Methods Inc., Adjustable Ramp for Loading Docks ..Mar-62
Solvay Process Division of Allied Chemical & Dye Corp., Booklet on Sodium Nitrate as Rust Inhibitor Mar-62
Sporlan Valve Co., Illustrated Talks May-73
United States Gauge Division, American Machine & Metals Co., Bulletin on Recording and Controlling Instruments Apr-62
Worthington Corp., Bulletin on Packaged Liquid Chillers ...Mar-62
Bulletin on Pumps Mar-62
Compressor Erection Paper Apr-62
Chemical Company Uses Refrigeration to Separate Gases (illus) Mar-58
City Products Corp., Annual Report ..May-30
Buys Florida Ice Plants Jan-9
Cold Storage Control in Great Britain Ends Jan-29
College Ice Skating Rink (illus) Jun-22
Colorado Ice & Cold Storage Company Adds Appliance Sales (illus) .Jan-29
Commercial Storage of Fruits and Vegetables, Florist & Nursery Stock Jan-18
Continuous Freezing Tunnel Processing, Philadelphia Warehouse .Apr-19
Plate Freezer Speeds Up Processing of Frozen Foods (illus) Jun-18

D

Deaths:
Espy, J. Reimer Jun-58
Foley, Charles F. Jan-50
Gallup, James May-70
Harris, Kline Mar-56
Knight, Joel J. Jan-50
O'Brien, William J. Apr-60
Rhode, Fred F. Feb-52
Spaulding, James S. Feb-43
Wenerka, Fred A. Jan-50
Dehydrofreezing Methods Adaptable to Commercial Adoption Jan-30
Delta States Holds Convention Feb-44
Ice Association Spring Meetings ..May-65
Doehler, Max K. Jr., How to Buy Types of Insurance (illus) ..Feb-13
Dry Ice and Brine Refrigerants Used For Low Temperature Carilloy Tests (illus), E. N. Zimmerman Jun-21

E

Eggs, Upgrading of Charged in News Story Feb-50
Engineers Learn Dairy Refrigeration Uses (illus) Mar-31
Environmental Test Chambers Subject Electronic Equipment To Varying Temperature Humidities and Corrosion (illus) Feb-50
Evaporator Tank Collapses While Under High Vacuum (illus) .Jan-28

F

Florida Ice Men Annual Convention ..Jan-26
Foremost Dairies Continues Expansion Feb-8
Freezing Methods Aid Florida Fish Industry Jan-48
Tested Jan-48
Frozen Food Discussed at Chicago ASRE Meeting Jan-51
Leaders Discuss outlook and Marketing problems May-24
Uses More Freezer Space Apr-52

G

Georgia Ice Convention Apr-55
Gregg, H. T. Jr., Sub-Zero Treatment of Metals (illus) Jan-19

H

Heat Pump Conserves Fuel in the Arctic (illus) Mar-28
Holaday, K. M., How Dangerous is Ammonia (illus) Feb-31
Hold-Over Cold Plates For Truck Refrigeration (illus) Mar-26

I

Ice Conventions Regional May-29-Jun-52
Directory For Truckers Jan-49
Rinks Maintenance and Construction Details (illus) Jan-27
Vending Sales. **O. A. Reardon** Feb-26
Illinois Association of Ice Industries Fall Conference Jan-26
Impressions of An Australian Abroad (illus) **J. J. Budge** Mar-49
Indiana Associations Annual Con. May-26
Innovations in Apple Handling Methods Jun-54
Insurance, How to Buy Types of (illus) **Max K. Doehler, Jr.** Feb-13

K

Kelahan, J. R., Tenants Purchase Refrigeration Service in Large Shopping Center (illus) Jan-13
King, Guy R., Characteristics and Applications of Refrigerants Old and New (illus) Apr-34
Kirby Ice Bowl Skating Rink (illus) .May-25
Kuehn, James H., New Storage Products for Warehouse May-23

L

Liquid Egg Production Mar-27
Los Angeles Grocer Chain Builds Own Frozen Foods Storage Plant (illus), K. V. Brown Jun-15

M

Manufacturers News:
Armstrong Cork Co., Warnock Advanced Jan-54
Ansul Chemical Co., Pays Safety Bonus to Workers Mar-60
H. E. Beyster & Associates, Detroit Architects Open New Offices .Feb-54
Borden Company, Refrigeration Units in Dairy Delivery Trucks Charged (illus) Mar-64
S. W. Brown, Refrigeration Consultant Firm Mar-60
A. M. Byers Co., Markets New Wrought Iron Tubing Feb-53
Carrier Corp., Affiliated Gas Merger Feb-54
Centrifugal to Puerto Rican Refinery Feb-53
Caterpillar Tractor Co., Australian Subsidiary Formed May-72
Creamery Package Mfg. Co., Payne New Houston Manager May-72
Dole Refrigerating Co., DeBaugh District Sales Manager Mar-61
E. I. duPont deNemours Co., Ends Drop Shipments of Freon Feb-53
Sells Ammonia Facilities In St. Louis to Barada & Page Jan-54
Ton Tanks of F-22 .....Feb-53
General Chemical Division, Allied Chemical & Dye Corp., Increases Capacity Mar-61
Jamison Cold Storage Door Co., Duffy New Sales Manager ...Apr-60
Kramer Trenton Co., Peterson Joins Sales Staff May-72
Mojonnier Bros., Dow New Sales Engineer May-72
National Rejector Inc., Adds New Service Engineers Mar-60
E. H. O'Neill Floors Co., Shute Joins Fire Ban Feb-54
Owens Corning Fiberglas Corp., Conducts Seminar For Meat Packer Engineers (illus) Mar-59
Fiberglas Marketed by Armstrong May-72
Reid Named to Sales Builders Club May-71
Shows Production Line Jun-59
Pittsburgh Corning Corp., Insulating Blocks with Ceramic Finish ..Apr-61
Plonsker Engineering Co., Oberlin Associates with Feb-54
Royal Palm Ice Co., Modernizes Plant (illus) Mar-64
Sporlan Valve Co., Hawco Joins Sporlan Feb-53
Holds Sales Conference Jan-54
Niedermeier to Kansas City Feb.-53
S & S Vending Machine Co., Installations Apr-62; May-72
Thermobank Inc., Builds New Plant in Detroit Feb-53
Trane Co., Engineering Seminar ..Mar-60
Union Ice, Named Bally Distributor Apr-62
U.S. Thermo Control Co., Thermo King Aids Truck Safety Campaign Jun-59
Vilter Mfg. Co., Trainee Returns to India Apr-60
Worthington Corp., Opens Industrial Exhibit Jan-54
York Corp., Court Holds Ice Making Machines Infringe Patents ..May-71
Dowling New Assistant Vice-Pres. Feb-54
Report Apr-60
McGraw Electric Buys Coolerator Feb-9

Meat Packer Reports-Mechanically Refrigerated Freight Cars (illus) **Ralph W. Ransom** Jun-26
Merchants Announces New Warehouse Feb-9
Minute Maid Buys Snow Crop Jan-8
Missouri Ice Convention Mar-52
Modernizing the Older Multi-Story Warehouse (illus), L. M. Ashenbrenner Jun-23
Mountain States Annual Convention .. Jun-56

N

National Association of Refrigerated Warehouses Annual Meeting . May-14
Ice Association Regional Conference May-29-Jun-52
Training Conference Refrigerated Warehouse Industry Feb-45
New Equipment-Machinery-Appliances, Processes:
Acme Industries, New Flow Mizer Cooling Towers (illus) May-4
Air Induction Conditioner, Truck Refrigeration System Uses Ice May-5
Allegheny Ludlum Steel Corp., Steel Hardens at Low Temperature . Jan-7
Allin Mfg. Co., Liquid Eye Indicators in Iron Pipe Sizes (illus) Mar-6
Allis-Chalmers Mfg. Co., Wound-Rotor Motor Feb-5
Alpha Metals Inc., Soldering Paste .. Jan-5
American Plate Freezer Co., Contact Plate Freezer For Fish Mar-7
Anemostat Corp. of America, New Air Meter (illus) May-4
Ansul Chemical Co., Device Detects Moisture in Refrigeration Systems (illus) Apr-4
Fire Extinguisher For Low Temperature Jun-4
Aqua Electric Scale Control, Improved Scale Control Unit Feb-7
Bacharach Industrial Instrument Co., Psychrometer for Field Service Mar-7
Baltimore Aircoil Co. Inc., Evaporative Condensers and Cooling Towers (illus) May-5
Bell & Gossett Co., Pressure Relief Valve (illus) Feb-5
Boyertown Auto Body Works Sealed Circuit Refrigeration Featured in New Truck Body (illus) .. May-7
Carrier Corp., Ice Making Machines (illus) Mar-6
Cash Mfg. Co., Floating Ring Valve Feb-5
Caterpillar Tractor Co., Diesel Engines For Refrig Service Mar-7
Champion Bronze Powder & Paint Co., Rust-Proof Primer (illus) Jan-4
Clark Door Co., Automatic Doors For Refrigerated Rooms Apr-6
Constad Laboratories, Liquid Zinc For Rust Control Jan-7
Creamery Package Mfg. Co., Announces "VS" Ammonia Compressor (illus) Jan-5
Dean Brothers Pumps Inc., Process Pumps Feature Interchangeability of Parts (illus) May-6
Dole Refrigerating Co., Automatic Defrost Device (illus) Jun-4
F. W. Dwyer Mfg. Co., Gauge Determines Blower Speed (illus) . Jan-4
Electric Controller & Mfg. Co., High Voltage Starter (illus) Feb-7
Erie Tool Works, Pipemaster Vise .. Apr-6
Fire Gun Sales Corp., Fire Gun For Soldering (illus) Feb-7
Foster-Built Bunkers Inc., Truck Refrigeration Unit for Dry Ice (illus) Jun-8
Foxboro Company, Instrument Records Process Temperatures .. Jan-4
Magnetic Flow Meter (illus) Feb-4
Frick Co., Finned Cooling Coil Mar-6
Ice Maker Produces Shell Ice Jan-6
Fruehauf Trailer Co., Refrigerated Reefer (illus) Mar-8
Fulton-Sylphon Division, Robertshaw Fulton Controls Co. Float Valve For Liquid Levels Mar-8
Harris Refrigeration Co., Microtome Cryostat For Pathological Research (illus) May-4
Haskelite Mfg. Co., Hasko-Struct Insulated Panels (illus) Apr-7
Hastings Instrument Co., Electronic Flowmeter Fits Palm of Hand Jan-4
Howe Ice Machine Co., Booster Compressor (illus) Mar-7
King Company of Owatonna, Minn., Heating-Ventilating-Cooling Unit (illus) Jun-6
Vestibule at Refrigerated Entrance (illus) Jun-7
Kold Hold Division of Tranter Mfg. Co., Live Axle-Power Source For Trailer Jun-6
Lehigh Safety Shoe Co., Safety Shoe Feb-5
Lewis-Shepard Products Inc., Counterbalanced Tilting Lift Truck Apr-6
Pallet Truck Has Safety Brake .. Mar-9
Liquid Carbonic Corp., Dry Ice Loading Chart (illus) Feb-5
Lunkenheimer Co., Introduces PVC Valve and Fittings (illus) Feb-4
Marley Company, Announces Double-Flow Aquatower (illus) Jan-7
Mercoid Corp., Two-Stage Temperature Control (illus) Apr-4
Weather Resistant Pressure Controls (illus) Mar-7
National Electric Products Corp., Heavy Duty Steel Electrical Conduit (illus) Jan-6
E. H. O'Neill Floors Co., Light Weight Fire Retardent Insulation Finish Jan-5
Peerless of America, Inc., Direct Expansion Evaporation with Blowers (illus) May-4
"No Water" Condenser (illus) .. Jun-4
Pennsylvania Salt Manufacturing Co., Corrosion Resistant Primer ... Feb-5
Resin Corrosion Protection Introduced by Pennsalt Apr-6
Pittsburgh Steel Products Co., Steel Containers for Small Packages in Storage (illus) Jun-8
Powers Regulator Co., Pneumatic Relays (illus) May-5
Pyle National Co., High Velocity Converter For Air Cond. Mar-6
Rempe Co., Condenser Eliminates Need For Water (illus) Apr-6
Paul C. Roche Co., Soldering Tools Available To Industrial Users Mar-9
Santa Fe Tank and Tower Co., Cooling Tower Controls Recirculation (illus) May-6
Stic-Klip Mfg. Co., Flexible Door for Warehouses (illus) Jan-6
Syntron Co., Hammer Drill (illus) . Feb-4
Tal Bender, Inc., Portable Hydraulic Bending Tool for Pipe (illus) . Apr-4
Thermal Agency, Spray Nozzle For Cooling Towers (illus) Feb-4
Thermo Instrument Co., Capacitive Level Control (illus) Jan-6
Typhoon Air Conditioning Co. Inc., New 30-Ton Package Unit .. Jun-8
Universal Metal Hose Co., Flexible-Metal Electrical Wiring Conduit (illus) May-5
Wassco Electric Products Pliers Tool For Soldering Copper Tubing (illus) Jun-8
J. E. Watkins Co., Liquid Refrigerant Circulator (illus) Jan-5
Spray Chiller Delivers High Heat Transfer Rate (illus) Jun-4
Wen Products Inc., Soldering Gun Jan-4
North Carolina Ice Convention Apr-55
Nussbaum, Otto J., Air Cooled Condensers For Large Tonnages Mar-15
Northwest Ice Convention Jun-56

O

Ohio Ice Association Holds Annual Meeting May-26
Outdoor Plastic Ice Rink for Chicago Skaters (illus) May-25

P

Peruvian Fish Industry Modern Refrigeration Expands Jan-52
Philadelphia Warehouse Adds Fast Freezing Tunnel Processing . Apr-19
Portraits:
Ashley, Carlyle H. Jan-23
Blatt, Robert C. Jan-23
Boling, Cecil Jan-23
Brandt, Fred T. Feb-51
Bright, Geo. B. Apr-42
Buehler, Leon, Jr. Jan-23
Carlson, A. R. Jan-50
Conley, Charles A. Apr-42
Cross, R. C. Jan-23
Dalton, Wm. May-14
DeBaugh, Howard W. Mar-61
Diehl, H. C. May-22
Doehler, Max K., Jr. Feb-13
Dow, John May-72
Duffy, Patrick J. Apr-60
Efroymson, A. B. May-13
Etzel, Leroy Feb-33
Gubser, Regis Jan-46
Haller, Charles W. May-53
Hawco, Frank C. Feb-53
Hoadley, Walter E. Jan-54
Howell, F. B. May-55
Johnston, Clem D. Apr-51
King, Guy R. Apr-50
McDermott, H. T. Apr-42
McKenna, Bert Mar-46
Neff, John W. Apr-42
Northam, Paul E. Jun-41
Niedermeier, R. E. Feb-53
Nissen, Harlan May-22
Overstreet, John Mar-36
Payne, John H. May-72
Peterson, Hans P. May-72
Quinn, Emmett Mar-34
Rehard, John C. Jun-41
Reid, Robert T. May-71
Robinson, F. M. Apr-60
Shute, John T. Feb-54
Soumerai, Henri Jun-60
Spoehrer, H. F. Jan-23
Warnock, M. J. Jan-54
Watson, Jay R. Apr-42
White, Burt C. Apr-42
Wischart, Harvey A. Jun-41
Young, M. W. May-14
Practical Refrigerating Engineers .... Jan-31; Feb-31; Mar-31; Apr-34; May-43; Jun-34
Ammonia, How Dangerous Is (illus) **K. M. Holaday** Feb-31
Business Side of Engineering, **C. T. Baker** Jan-31
Educational Conference Jun-40
Engineers Learn Dairy Refrigeration Uses (illus) Mar-31
Refrigerants, Characteristics and Applications of **Guy R. King** .. Apr-34
Selecting and Using "Freon" Refrigerant **W. R. Barnard** May-43
Vapor Barrier Requirements For Cold Storage (illus) **S. J. Stachelek** Jun-34

R

Railway Express Adds Three Hundred Ice Refrigerator Cars (illus) . Apr-25
Ransom, Ralph W., Meat Packer Reports Mechanically Refrigerated Freight Cars (illus) ... Jun-26
Reardon, O. E., Increasing Vending Sales Points to Feb-26
Refrigerants, Characteristics and Applications of (illus) **Guy R. King** Apr-34
Refrigerated Warehouse Center, Calumet Industrial District (illus) Feb-24
Barge Keeps Fish Fresh Jun-57
Warehousing Industry Holds National Training Conference .. Feb-45
1955 Directory Issued Jun-52
Refrigeration in the Dairy Industry (illus) **Earl E. Bergstrom** .. May-32
Plant Adapted to Serve Changing Processes and Products (illus) **W. F. Stoecker** Apr-15
Research Foundation Annual Meet May-22

S

Scientific Advisory Council Reviews Research and Technical Subjects Mar-27
Selecting and Using Freon Refrigerant (illus) **W. R. Barnard** May-43
Skating Rink Specializes in Curling .. Jan-43
Shopping Center Northland Center, Detroit, Michigan (illus) **J. R. Kelahan** Jan-13
South Carolina Ice Convention Mar-52
Southern Ice Convention Apr-55
Southwestern Sales Meet Jun-32
Stachelek, S. J., Vapor Barrier Requirements for Cold Storage (illus) Jun-34
Stoecker, W. F., Refrigeration Plant Adapted to Serve Changing Processes and Products Apr-15
Storage Capacity of Refrigerated Warehouses Biennial Survey Mar-21
Products for Warehouse, **James H. Kuehn** May-23
Survey More Refrigerated Space Needed for 1955 ..... Apr-30
Sub-Zero Treatment of Metals (illus) **H. T. Gregg** Jan-19
Super Refrigerator Cars For Low Temperatures Feb-48
Symposium on Low Temperature Standards for Containers Mar-48

T

Tenants Purchase Refrigeration Service In Large Shopping Center (illus) **J. R. Kelahan** Jan-13
Tests of Insulated Structures Jun-53

U

Upgrading of Eggs in Cold Storage Charged in News Story Feb-50
U. S. Project Studies Low Temp. Feb-22

V

Vapor Barrier Requirements for Cold Storage (illus) S. J. Stachelek Jun-34

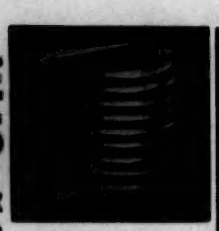
W

Warehouse Frozen Foods Luncheon Meeting Apr-52
Industry Improves Safety Record .. Jan-22
Wellman, E. K., Economics of Ice Distribution Mar-30

Z

Zimmerman, E. N., Dry Ice and Brine Refrigerants Jun-21

PIPE BENDS & COILS



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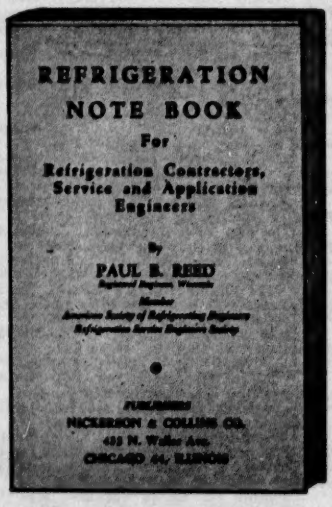

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ADVERTISERS

Ansul Chemical Co. 49
Armour & Co. 31
Armstrong Machine Works 59

Ballard Sales Co. 60
Bateman Foundry and Machine Co., Inc. 58
Barada & Page, Inc. ..... 10 and 11
Bower Chemical Mfg. Co., Henry 58
Butcher Boy Refrigerator Door Co. 1

Caterpillar Tractor Co. 12
Chicago Nipple Mfg. Co. 64
Classified Advertising 61
Creamery Package Mfg. Co. 14

Enterprise Equipment Corp. 61

Frick Co. 47

General Chemical Div., Allied Chemical & Dye Corp. 9
Gifford-Wood Co. ..... Inside Front Cover
Greene, Van R. H. 64

Henry Valve Co. 5
Howe Ice Machine Co. 53

International Salt Co., Inc. 44

Jamison Cold Storage Door Co. Back Cover

King Co. of Owatonna, The 55
King Zeero Co. 59
Knickerbocker Stamping Co. 43
Kramer Trenton Co. 6

Lewis-Shepard Products, Inc. 2
Link-Belt Co. 45

National Pipe Bending Co. 33
Niagara Blower Co. 57
Nickerson & Collins Co. 64

Ohio Galvanizing & Mfg. Co., The 55
Ophuls & Associates, Fred 64
Owens-Corning Fiberglas Corp. ..... Inside Back Cover

Perfection Ice Scoring Machine Co., The 51
Phillips & Co., H. A. 61
Pittsburgh Corning Corp. 35
Prosstite Engineering Co. 41

Refrigeration Engineering Co. 38
Rempe Co. 61

S & S Vending Machine Co. 60
Schoolkopf Mfg. Co. 32
Shank Co., Cyrus 47
Solvay Process Div., Allied Chemical & Dye Corp. 25

Taylor Instrument Companies 7

United Cork Companies 27

Voss Co. Inc., J. H. H. 29

Wanted and For Sale Advertising 61
Wright Chemical Corp. 51

Fiberglas PF Dry Wall

3 Ways Better!

PLANTATION COLD STORAGE COMPANY, MIAMI, FLA. One of the south's newest, most modern cold storage plants. Capacity . . . 172,000 cu. ft. • Insulation . . . 225,000 bd. ft. Fiberglas Insulations.

PLANTATION COLD STORAGE DIVISION

PLANTATION FOODS CORPORATION
ULETA, FLORIDA

April 8, 1955

Mr. Allan W. Cox, Manager
Low Temperature Insulation Sales
Owens-Corning Fiberglas Corporation
Toledo 1, Ohio

Dear Mr. Cox:

Here is a brief report on our experience with Fiberglas Insulation in the addition to our new Miami plant.

When we had decided on using Fiberglas as our insulating material, you recommended a single vapor barrier, using your dry wall construction. We at that time had some doubts as to whether it would stand up as well as the conventional multiple barrier methods using other materials. Today, after more than six (6) months of service, we are glad we followed your recommendation.

First - we saved money on the installation. Second - operating costs are well within the most optimistic estimates. Third - there has been absolutely no condensation problem, which means that our fears about the single vapor barrier were groundless. Finally, we know that if we ever decide to remodel, we can salvage and re-use both the Fiberglas and the wallboard.

You may quote us as saying that, from every standpoint, Fiberglas has been a most worthwhile investment for us. We can heartily recommend it.

Sincerely,

PLANTATION COLD STORAGE

Walter S. Griffith
President

It's the simple, trouble-free construction combined with unsurpassed thermal efficiency that makes Fiberglas® PF Dry Wall Construction the ideal choice for cold storage plants.

The above letter from Walter S. Griffith, President of the Plantation Cold Storage Division, Plantation Foods Corp., Uleta, Florida, stresses these three important points—

- Installation economies
- Low operating costs
- Freedom from risk of condensation

Instead of several vapor barriers, there's just one. Instead of being asphalted in place, the fire-resistant Fiberglas panels are set dry between treated wood studs. Instead of being solid, the interior finish is perforated.

Any vapor that succeeds in penetrating the barrier passes completely through the wall without condensing. The insulation stays dry . . . stays efficient . . . maintains the specified temperature level.

Wouldn't it be worth your while to get all the facts about Fiberglas Insulations? Send the coupon today! Owens-Corning Fiberglas Corp., Toledo 1, Ohio.

FIBERGLAS

®T. M. Reg. Owens-Corning Fiberglas Corporation

Owens-Corning Fiberglas Corporation
Dept. 165-F, Toledo 1, Ohio

Please send me the literature I have checked below.

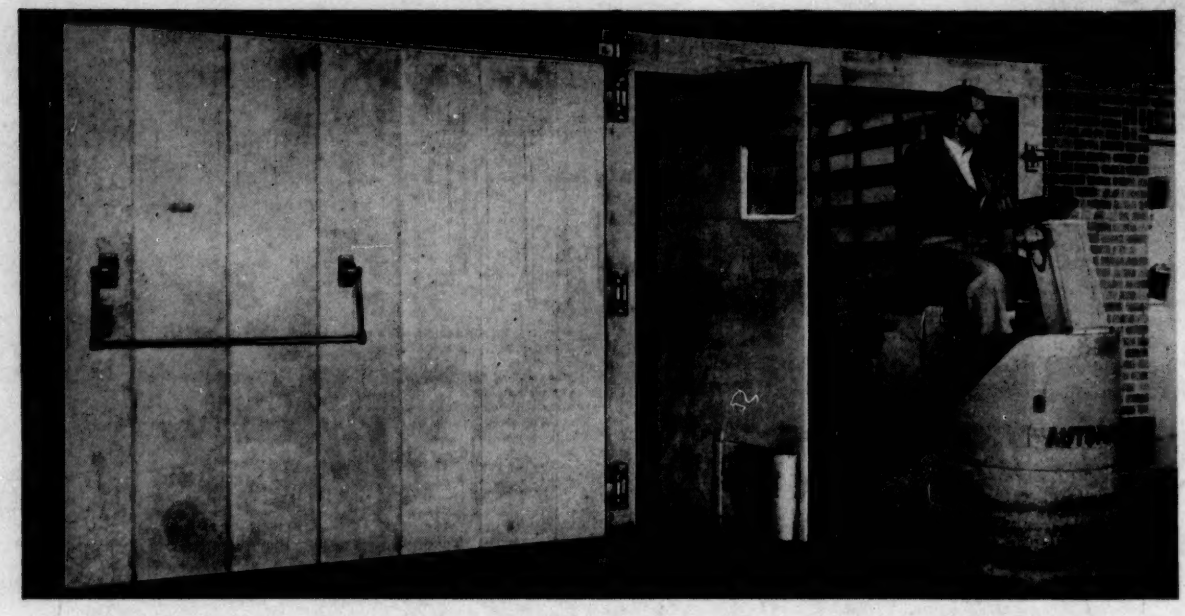
- ☐ "Insulation for Low Temperature Structures and Equipment"
- ☐ "PF Design Details"
- ☐ "Why the Trend is to Fiberglas"

Name and Title_____

Company_____

Street_____

City_____ Zone_____ State_____

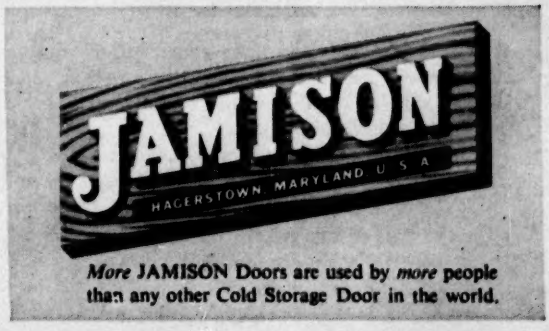


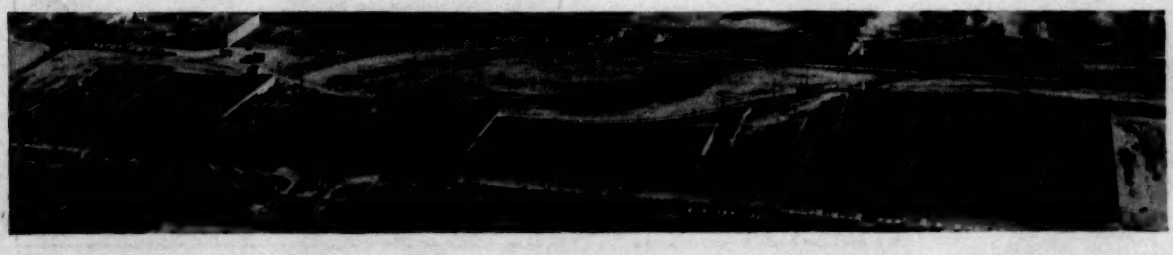
COLD STORAGE DOORS A BIG 8 FEET WIDE give lots of clearance for both trailer type and fork lift trucks. Vestibule doors hold down cold losses. Frames provide rigidity in supporting the doors.

SAFEWAY Keeps Foods on the Go through JAMISON Engineered Doors

At Safeway Stores' mammoth distribution center in Denver, Colorado, most foods aren't really stored . . . they're moved in and hours later, just as quickly moved out. Eighty-seven Jamison Doors help to make this high-speed handling possible. They're engineered to open quickly . . . to speed traffic . . . and to prevent excessive cold losses while doing it.

For additional facts about Jamison Doors, see your architect or write to JAMISON COLD STORAGE DOOR CO., HAGERSTOWN, MD.



More JAMISON Doors are used by *more* people than any other Cold Storage Door in the world.

SAFEWAY STORES' VAST DISTRIBUTION CENTER in Denver efficiently serves 127 of their stores over a four state area.